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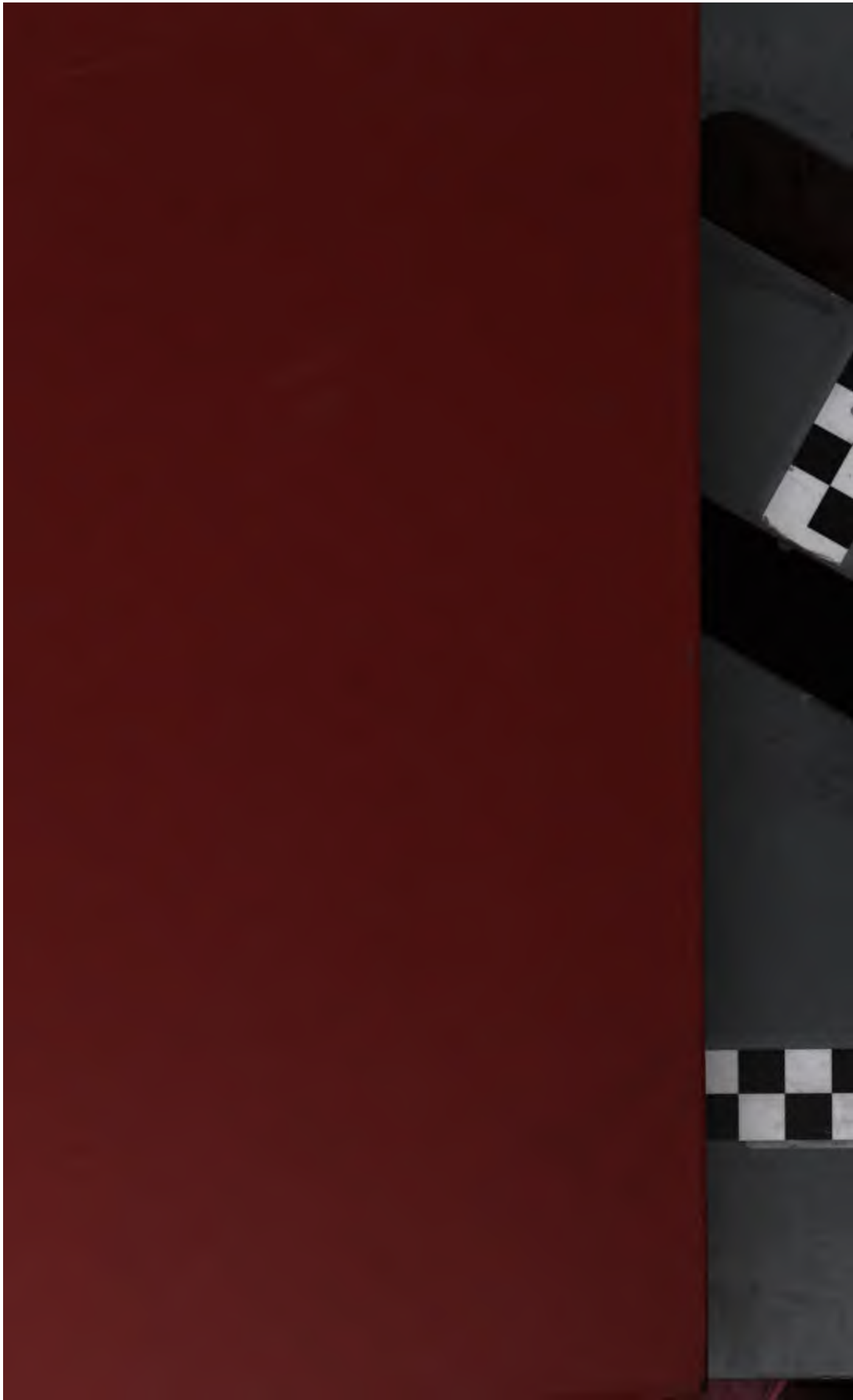
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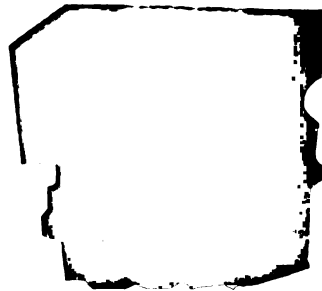


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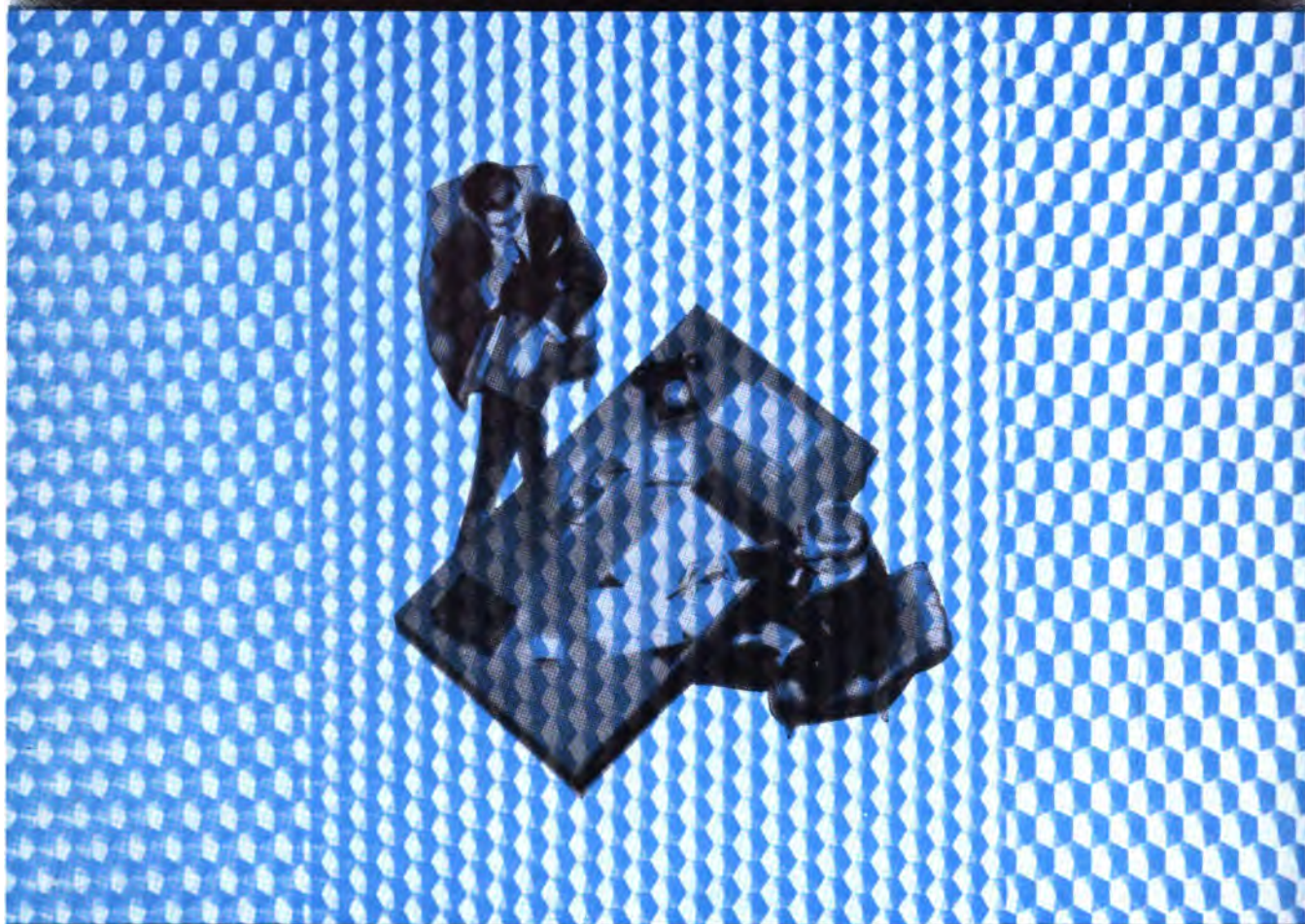


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ime que les nouveaux plans d'électrification des
de Fer Britanniques exigeront 200 MW du
ublic de distribution, à un facteur de charge
itre 0,67 pour les lignes les plus chargées et 0,26
moins chargées. On estime la consommation
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système de transport national, par l'intermédiaire
stations équipées de transformateurs Scott ou
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autres opérations de commutation seront télé-
ées par un système à fréquence vocale à partir
de commande. Tout l'appareillage de commuta-
rotégé et utilise des disjoncteurs à bain d'huile
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s de la Distribution ... 516
sports annuels des organismes nationalisés qui
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ys de Galles font apparaître une utilisation
des disjoncteurs à réenclenchement rapide pour
la continuité de l'alimentation. L'intérêt mani-
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reuses, s'est maintenu. Les conducteurs en
pour câbles ont été largement utilisés et on a
des essais sur les isolants plastiques pour câbles
La difficulté que présente le problème de l'em-
des sous-stations a fait croître l'intérêt pour
ormateurs enterrés dont le radiateur de re-
ent seulement se trouve à l'air libre.

ieurs Canadiens visitent l'URSS ... 528
éniéurs canadiens qui sont allés en URSS pour
s installations d'alimentation jugent cet équipe-
markable" dans le domaine de la transmission
te fréquence et de la génération hydroélectrique.

ser Nummer

b im 25 kV, 50 Hz-Netz ... 507
Elektrifizierungsvorhaben der britischen Eisen-
erden schätzungsweise insgesamt eine Leistungs-
in der Höhe von etwa 200 MW an das öffent-
sorgungssystem stellen, bei einem Belastungs-
en, der zwischen 0,67 für die am schwersten und
ie am leichtesten belasteten Leitungen schwankt.
iche Leistungsaufnahme wird auf etwa 950
kWh geschätzt. Die Leistungszufuhr erfolgt aus
undnetz durch Unterwerke, die mit einphasigen
Scottscher Schaltung angeordneten Transform-
gerüstet sind. Sämtliche Stufenschaltungen und
chaltvorgänge werden von Kontrollräumen aus,
infrequenzsystem ferngesteuert sein. Sämtliche
te werden in geschlossener Bauart ausgeführt.
Fahrstromleitungen werden Oelabschalter ver-

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für England und Wales lassen die zunehmende
ig schnellwirkender wiedereinschaltender Aus-
kennen u. zw. im Interesse erhöhter Belastungs-
Beträchtliches Interesse wird weiterhin elek-
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gebracht. Aluminiumseelen sind im Kabelbau
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ner Kunststoffe als Netzkabelisolierung ist
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stellen, geht man im Unterwerksbau dazu über,
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che Ingenieure, die U.d.S.S.R. besuchten um
lagen zu besichtigen, bezeichneten als "hervor-
das, was sie auf dem Gebiete der Ultrastark-
regung sowie der Wasserkraftanlagen zu sehen

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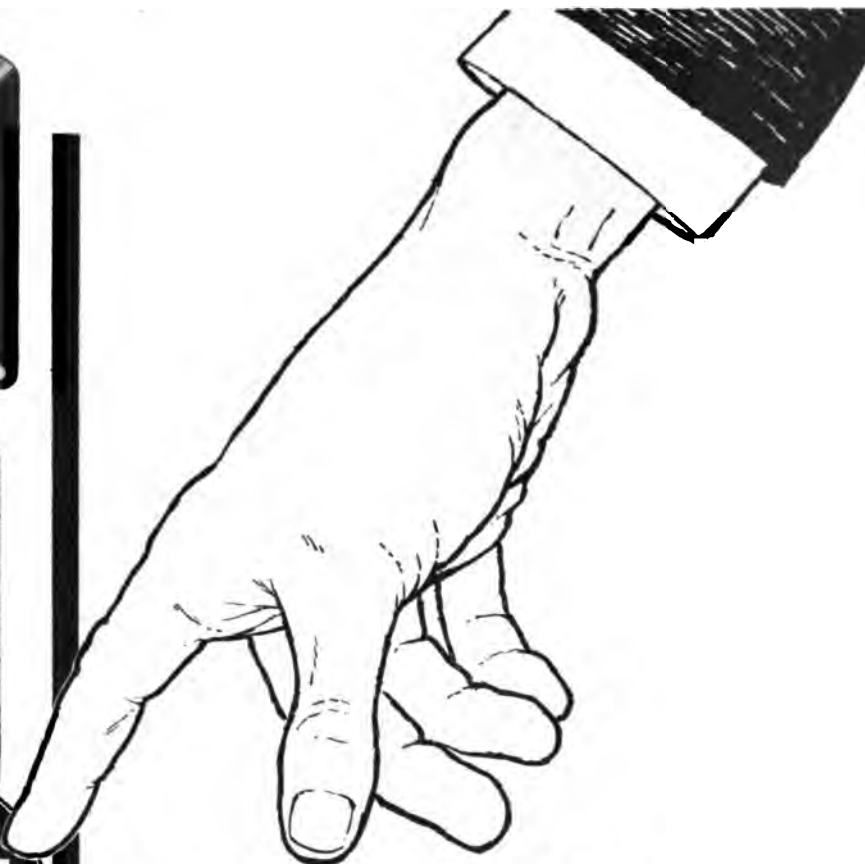
Watertight pattern
surface mounting
2 CSU/W
"Start"—"Stop"



Watertight pattern
surface mounting
3 CSU/W
"Forward"—
"Reverse"—"Stop"



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1 CSU
"Stop" only



Surface mounting
enclosed pattern
1 CSU/L
Push to
lock "Off"
Turn to release



Surface mounting
enclosed pattern
2 CSU
"Start"—"Stop"

Watertight pattern
surface mounting
33 CSU/W
"Start"—
"Inch"—"Stop"



MEM Push Button Control Stations meet every requirement associated with the remote control of electric motor starters. In addition to the models illustrated, the range includes flush inset patterns for recessing into machine tools, etc., and bayonet entry models for suspension by conduit. Forty different models are available from which to make a choice. A wide range of Control Stations is also available for use on machine tools and other equipment intended for export to Canada. These models are C.S.A. Approved and bear the C.S.A. Approvals No. 132

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 6 OCTOBER, 1960

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Comment

TARIFFS ON TRIAL

After Sir Robertson King had set the backcloth by stating bluntly that electricity prices would have to go up, two area boards have followed quickly by announcing increased tariffs in the domestic and commercial classes. Other chairmen, also, have taken the opportunity of this annual period of stocktaking to give warning of impending higher prices. The two boards, however, South East and South Wales, can point to lower returns on capital employed than any other board, 0.29% and 1.18%, respectively, and most of the tariffs concerned tend to show a lower yield than the national average. But whatever may be the justification in these cases, in general, area board finance does not look unhealthy. The surplus, after paying all interest charges, rose from 2.4% in 1958-59 to 2.78% of total assets. It is the heavy additional burdens that have to be carried during the second half of the current year that have set the distress signals flying. First, there is the substantial rise in the wage and salary bill, which cannot be offset by the steadily increasing units sold per man. Then there is the rise of 5s 1d/ton in the price of coal, estimated to cost a further £11 to £12 million. This, however, has to be viewed against the 6s 3d/ton fall over the last two years in delivered coal cost due to the praiseworthy concentration of generation in short-haul stations. A greater problem for the industry is the drive towards more self financing. The undertaking to find an average of 48% of the industry's capital needs from revenue over the seven years to 1965 is proving unduly onerous. The figure has fallen from 47.4% in 1958-59 to 43.6% last year, so the industry is already nearly £15 million behind the target average. With the CEBG plant programme being revised upwards, clearly this 48% self-financing target is beginning to look unrealistic. This is a matter that needs consideration; one which, in any case, will come before Parliament next autumn, when the Electricity Council will need an increase in its borrowing powers.

DEMAND GROWTH EMERGENCY

Estimates of demand growth on the CEBG system have been persistently below realisation. This admission is one of the major revelations of the recent Generating Board report, though there is strangely little about it in the Electricity Council survey. Now the Board has decided that it must budget for a 1,200 MW larger demand in 1964 than it had previously provided for. At the 90% peak-period availability now taken for generating plant planning, that represents a sent-out capacity of 1,330 MW to be found, and of this, 650 MW is to come in extra sets in the 1964 programme, and the rest by postponing scrapping of old plant. The

question to be answered is: How much danger of failure to meet demand was occasioned by the underestimate? The figures suggest a 5% short-fall in desirable capacity without the supplementary programme, but this proportion has to be looked at with reference to its distance ahead in time. Between 300 MW and 400 MW of plant a year is being shut down in the interest of more efficient generation, so that there is a big reservoir for adjustment as each year's load experience corrects estimates for the years ahead. Also, the figure of 90% peak availability now being taken for planning purposes is, on recent experience, conservative, and so builds in additional safety factors. Thus, the additional generation required could probably have been found anyway, though without leaving much in hand for unforeseen contingencies. That the plant programme can be increased quickly in the way planned is a sign of one welcome easement—lag between planning and commissioning has been cut sharply from what it was a few years ago.

ISOLATORS OBSOLESCE?

By definition, an isolator has negligible breaking capacity and making capacity, although it should be able to cope with high through-currents. In the latest of the annual reviews of the electrical factory inspectorate there is attention to the danger implicit in such operating characteristics in both supply networks and in factory installations. Isolators are properly opened to provide safety while working on equipment, after controlling circuit-breakers have de-energised it; but they are liable to be the chosen means of reclosing a circuit when the work is finished, especially when the isolator is near and the circuit-breaker a long way distant. Accidents due to this cause, when the circuit has, in fact, been closed on to a fault, occur from time to time and are clearly causing concern. In factory installations, the isolator is often associated with a single item of equipment, a starter or a fuse board, but somewhat similar considerations apply. The ideal answer is to regard isolators as obsolescent and fit instead isolating switches having adequate making capacity. However, there are snags about this, partly financial and partly design—the medium-voltage switch, especially, may be large relative to the simple isolator. If too much emphasis is put on the point, the situation can be reached where the number of isolators was reduced, and safety would be likely to suffer in that way. Perhaps in supply networks the case for isolating switches with a fault-making capacity is strong enough; in factory distribution the argument against the simple isolator is less convincing, though undoubtedly deserving attention.

THE RAILWAY AS A LOAD

Development of the 50 c/s, 25 kV main line electrification system, which this week is receiving close international attention at the BTC conference, is another tribute to the versatility of the grid. Funda-

mental to the whole concept is availability of supply points for power infeed every 25 to 30 miles, reasonably close to the track, giving high supply security, and sufficiently closely coupled with the overall transmission system to diminish by swamping the potentially troublesome effects arising from single-phase rectified train loads. The tightly linked 132 kV grid meets these requirements so well that, in most cases, it is thought unnecessary to take any special precautions about harmonics due to rectification (other than providing a delta winding to suppress third harmonics) or against the unbalance introduced by concentrated single-phase loads. Where main lines are supplied from 132 kV substations, no complex transformer connections are adopted, just simple connection of single-phase units, with adjoining sections supplied from different phases to limit unbalance. But there is another side to this. Such simplicity follows in part because the railway load is only small compared with general system load, not the immense demand that casual talk of it—its desirability to the supply system has sometimes made it. The Euston-Manchester-Liverpool electrification will impose a maximum demand of about 110 MW and take 640 million kWh annually at a load factor of about 65%; suburban and branch lines are less attractive from the load factor aspect. Even when fully developed, the railway load is unlikely to exceed 3% of overall system demand. The attraction of rail electrification for manufacturing industry is a matter of considerably greater moment.

GREEN-YELLOW EARTHING AHEAD

A year ago the significance of international standards made an impact on the general public through the danger from imported appliances with flexibles which followed certain continental standards with red as the earthing core. The CEE has had this question of standard colours for flexibles under consideration for some time, and at the recent London meeting unanimous agreement was secured on a combination of green and yellow as the international identifying colour code for the earthing core. Some of the 15 countries, however, are recognising it only as an alternative to their own national standard. In addition, blue and black have been chosen as the colours of the other two cores, but with no recommendation as to which should indicate the live core. The UK delegation abstained from voting on this resolution. Such colours in this country are specified by the IEE wiring regulations committee, but it is the BSI that represents the UK on CEE. However, the IEE committee have been consulted unofficially and are not prepared to recognise any colour other than red for the live core. Thus, the British delegation could hardly have acted otherwise. On general ground, an excellent case can be made out for red as the "live" colour, but in present times it is necessary to keep in mind the increasing demands of international trade.

Meteor

This week's quick summary of electrical news faces advertisement page 20

50 c/s power for railways

EQUIPMENT USED AND METHOD OF CONTROL

UNDER their modernisation programme, British Railways have planned to electrify nearly 790 route miles of track, using the overhead conductor system operating at either 25 or 6.25 kV. The electrification scheme involves the London Midland main line and suburban schemes in the Eastern Region and the Scottish Region at Glasgow. The first stages of these last two schemes are expected to be in service by mid-November.

Features of the power supply installation and its control were described in several papers presented to the BTC conference on electric traction which began last Monday at the Institution of Civil Engineers and which is referred to on p. 511.

The papers dealt with in this article outline the demand on the CEGB's grid system and possible effects of unbalanced loading, arrangements for supplying power to the overhead conductors and restricting interference with telecommunication circuits, remote control of switching, and load measurement.

The lengths of track mileage to be electrified under the plan, together with the expected electrical loading, is shown in the table on page 508. Total demand, allowing for diversity of the different schemes, is estimated at 200 MW and the annual consumption will be about 950 million units. This demand represents only about 1% of units sent out by the CEGB last year.

The London Midland scheme caters for all classes of traffic from main line expresses to heavy goods and, as a result, the load factor at 0.67 is high.

Supply Arrangements

Before the decision to use the national grid as a source of supply for the railways could be taken, two major factors had to be investigated. These were, security requirement and the effect of railway load on the grid. Experience of bulk supplies to railways has been obtained on the extensive Southern Region system and on systems supplied by the SSEB. Reliability of the national grid for such supplies is clearly indicated by the loss of only 0.004 minutes for every million units supplied in a recent five-year period on the Southern Region.

The use of a single-phase track supply may cause trouble in the distribution system from two causes, unbalanced load and harmonics. An unbalanced railway load could produce voltage unbalance in the supply system, this in turn causing other balanced loads to draw unbalanced currents. A single-phase unbalanced load could also restrict the capacity of a network to supply balanced three-phase loads. Unbalanced currents in the supply system could cause overheating of generators.

Investigations carried out by the CEGB indicate that an unbalanced railway load is unlikely to cause difficulties provided the ratio of single-phase load to short-circuit power is less than 0.05. By taking the railway load at 132 kV the ratio is kept well below this value.

By sectionalising the overhead system, supply can be taken at different feeder stations across all three supply

phases. This should effectively prevent restrictions on the three-phase power supplied by the grid system as a whole.

Each grid supply point energises an isolated section of catenary, enabling adjacent sections to be connected across different supply phases. It would, in any case, not be practicable to supply track sections from more than one feeder point if circulating currents are to be avoided. If, for any reason, a track section has to be transferred from its own feeder point to that of the adjacent section, the change over is only made after a momentary break in the supply.

Generator overheating due to unbalanced currents is unlikely to occur if the 1-phase load is less than 10% of the generator nominal rating. In special circumstances it may be necessary to fit negative phase sequence current alarms to alternators to indicate this condition, but it is considered unlikely that such conditions will arise.

Little trouble is expected from harmonic voltages provided the precaution is taken to connect the traction load at points where the supply system short-circuit level is high and a delta winding is included in the supply transformer.

Bulk Supply Points

For the London Midland and the Glasgow suburban schemes, bulk supply substations are available in convenient places allowing for supplies to be taken direct from the grid. The Liverpool Street to Southend and Chelmsford lines overhead system, originally designed for 1,500 V d.c., already has a three-phase, 33 kV distribution, and although this has been used where possible, additional cabling and track feeder circuits have had to be provided.

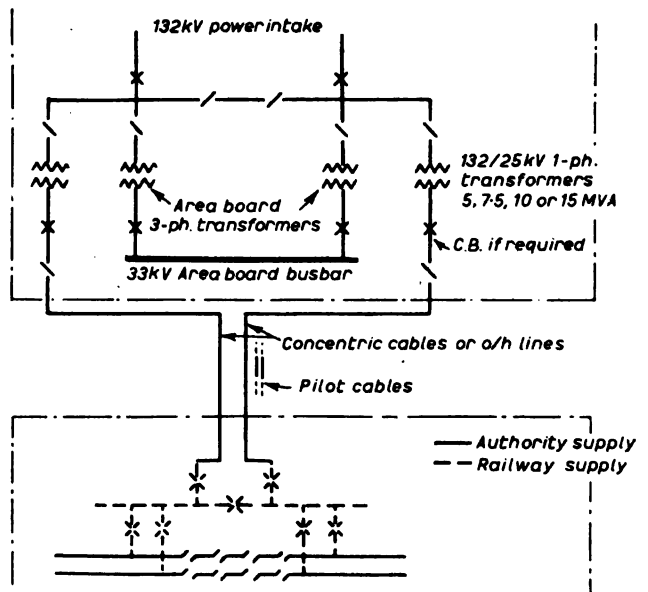


Fig. 1. Typical 25 kV power supply installation for 50 c/s railway electrification fed from a 132 kV bulk supply point

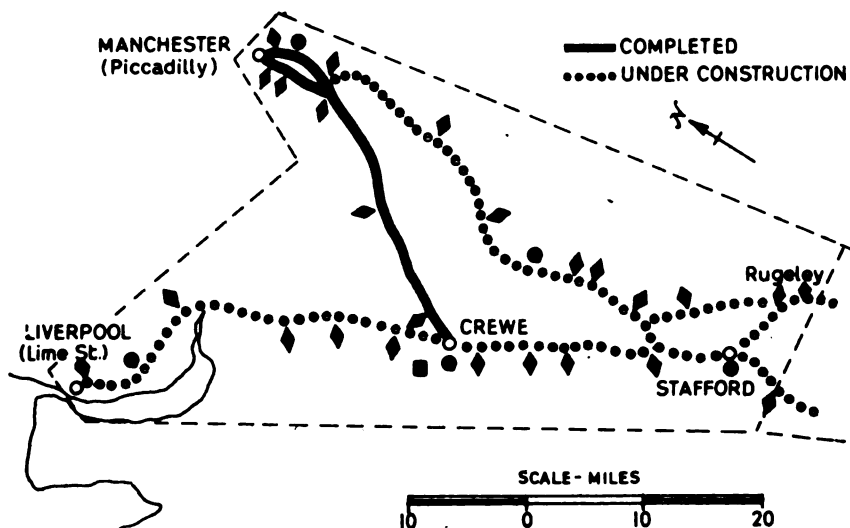


Fig. 2. The area covered by the control room at Crewe includes the recently completed first stage of the London Midland scheme from Crewe to Manchester

On both the Glasgow and Eastern Region schemes the number of low bridges and the congested conditions require considerable lengths of line operating at 6.25 kV. Here, the Liverpool Street line has an advantage because the existing 1,500 V d.c. insulators are suitable for the higher a.c. voltage. On this line, conversion to 6.25 kV is obtained through 33/6.25 kV transformers which may be either single- or three-phase or Scott connected to improve the out-of-balance loading between phases. Similar transformer arrangements are used in the London area connected to the 66 kV cable system.

Siting of the feeder points depends on a number of factors; for example, traffic density, performance expected of locomotives and supply system characteristics. Advantages of siting near junctions or route intersections must also be considered. On average, the feeder points for the 25 kV system have been sited at 25-mile intervals.

Supply Transformers

All substations on the London Midland and Glasgow schemes and the majority on the London and suburban schemes have 132/25 kV transformers. Security of supply is assured by using two transformers for the railway feeder, often paralleled with area board distribution supply transformers.

Connection of the railway feeder transformers to the 132 kV busbars rather than the l.v. system saves the expense of additional switchgear, since in all cases it has been possible to use existing 132 kV circuit-breakers. It also avoids variations in the local area board system load affecting the railway supply. On the other hand, the short-circuit level is higher. Although the railway transformers have 132 kV circuit-breakers in common with the supply system transformers, they also

have separate remotely controlled isolating switches. The 25 kV side at the grid substation is provided with isolators and earthing switches and connected to the railway substation through either a two-core concentric cable, or double-circuit overhead line, in which case a 25 kV circuit-breaker is also provided adjacent to the transformer. This breaker would be of the bulk type, rated 800 A 250 MVA, and capable of interrupting up to 3,000 A at 44 kV. Pilot cables for metering and tripping also link the grid substation to the railway feeder station.

A standard range of single-phase transformers is envisaged for the schemes. Ratings range from 5 MVA to 20 MVA in five steps for the 132 and 66/25 kV units and 2.5 MVA to 15 MVA for the 66 or 33/6.25 kV units. Transformers initially supplied were rated 7.5 MVA and 15 MVA with 14–1.43% steps of on-load tap changing. Later transformers have 4–5% steps of off-load tap changing provided. The SSEB are using 5 MVA and 10 MVA transformers with 4–2½% steps of off-load tap changing. Line-to-line connection prevents use of graded insulation on the 132 kV side and impulse test specified call for a sequence of chopped and full wave applied simultaneously to both line terminals in addition to the normal impulse tests.

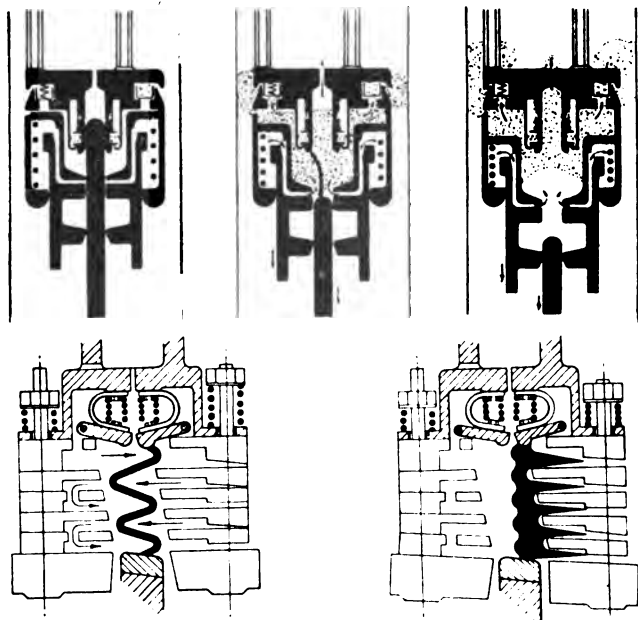


Fig. 3. The top illustration shows the three stages in the operating sequence of the Fuller oil-minimum contraction type circuit-breaker. An alternative arrangement used in the Switchgear and Cowan oil-insulated circuit-breaker is shown below it

Table 1. Power Demands for Electrification in hand at 25 kV and 6.25 kV

Scheme	Single Line Miles	No. of Supply Points	Max. Demand	Power Consumption Annual	Approx. Load Factor Annual
			MW	kWh (million)	per cent
L.M. Main Line					
Euston-Manchester-Liverpool	1,780	12	109	640	67
Scottish Region					
Glasgow Suburban (Stage I)	163	4	18	56	35
Eastern Region					
G.E. Conversions ...	174	6	49	148	34
Chelmsford Colchester ...	49	0			
Colchester-Walton ...	50	1			
London-Bishop's Stortford	105	4			
London-Southend ...	172	3	13	34	30
			27	61	26
Total ...	2,493	—	—	—	—

Track Feeder Cables

Cables linking the grid substation to the railway feeder substation are of the concentric type, either oil- or gas-filled. The gas-filled type, with a lower charging current is preferred for use in tunnels. Cross-section used is 0.5 sq in., although at Crewe it has been increased to

0.85 sq in. Outdoor sealing-end type terminations are in use on the Colchester-Walton lines, but on the London Midland and other Eastern Region extensions oil-immersed sealing-ends are being used for connections to the indoor switchgear. Extensions to the 33 kV system on the Great Eastern line will be of solid type three-core cable and also an oil-filled type with solid aluminium conductors without fillers and housed in a corrugated aluminium sheath.

For the new 25 kV concentric cables, a straight-through joint has been developed. This has a conventional hollow-core oil-filled arrangement for the inner conductor, while the outer conductor is joined by applying a copper tube over the central section of the inner screen and then connecting wires from each side, over the top of the tube. Stress cones are applied over the lead sheath terminations and the dielectric is reapplied over the outer conductor in the form of an open tube supported by spacers.

Pilot cables laid with the main feeder cables are of the 110 V mass-impregnated type, each having either four or seven 7/036 sq in. conductors.

It is convenient here, also, to mention the cable connections from the track-side feeder stations to the catenary and running rails. Connection from the 25 kV switchgear to the catenary is made through 0.15 or 0.2 sq in. single-core solid type cable. On some recent installations, mass impregnated non-draining cables are being installed alongside more conventional types to assess their performance. For the 6.25 kV connections, either 0.25 or 0.5 sq in. cables are used.

Feeder return cables from the running rails are of rubber-insulated 660 V 0.15 sq in., duplicated if necessary. The track-side cables are run in pre-cast concrete troughing if they cannot be directly buried. Where space is restricted post supports are used, aluminium cables being supported on hangers and lead-sheathed cables in asbestos cement tubes.

Track Feeder Points

Circuit-breakers and their ancillary equipment are housed in simple brick-built cabins with flat concrete roofs. Maintenance on the gear can thus be carried out, unaffected by weather conditions. The buildings are equipped with telephone communication to the control station exchange and also to depots and other strategic points such as tunnel entrances.

Switchgear has been standardised for two short-circuit ratings on the 25 kV system, 150 MVA and 300 MVA. The fault levels possible have been calculated as varying from 76 MVA with the track-side cabin at the mid-position of a two-track section to 166 MVA with the cabin at quarter-distance on a four-track section.

Proved designs of 25 kV switchgear were not available when the electrification plan was introduced and two types have since been selected. Both are of the cubicle type, but one is oil-insulated and the other is air-insulated. The oil-insulated type is made by Switchgear and Cowans and is in general use on the London-Midland and Scottish Regions, on the Eastern Region, the air-insulated type designed by Fullers predominates.

The compactness of the oil-insulated type gives the advantage of lower building cost but, on the other hand, with the air-insulated construction, fire risk is reduced and

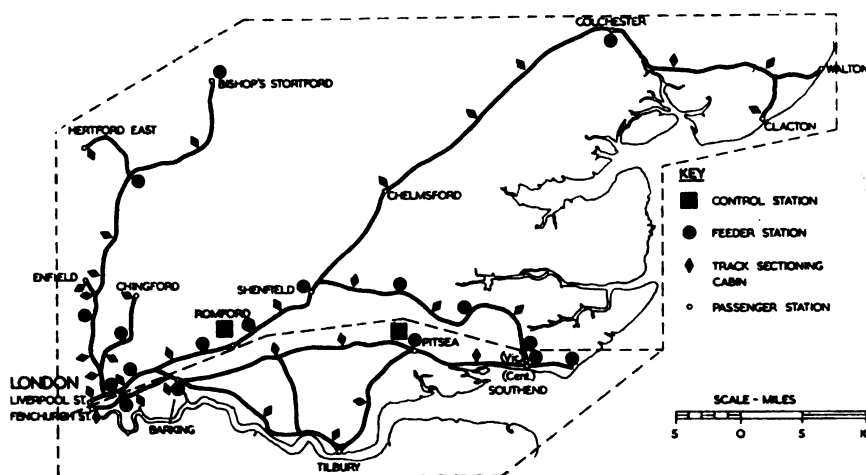


Fig. 4. The Eastern Region electrification scheme

a serious breakdown can be dealt with more quickly.

Both designs are solenoid operated, arranged for remote operation from the control room. Fully interlocked hand isolators are provided on both incoming and outgoing sides.

Air-Insulated Switchgear

The air-insulated switchgear is housed in three main compartments for: the incoming busbar, circuit-breaker and circuit isolator. All circuit-breakers, isolators and access doors are fully interlocked and glass inspection panels allow the isolator positions to be visually checked. The isolators have "closed" and "earthed" positions, avoiding the need for portable earthing equipment. The circuit-breaker is of the oil minimum contraction type developed originally for the Swedish railways' 16 2/3 c/s system. It is designed for a power frequency test of 103 kV and an impulse level of 200 kV with a 1/50 μ sec wave. For the

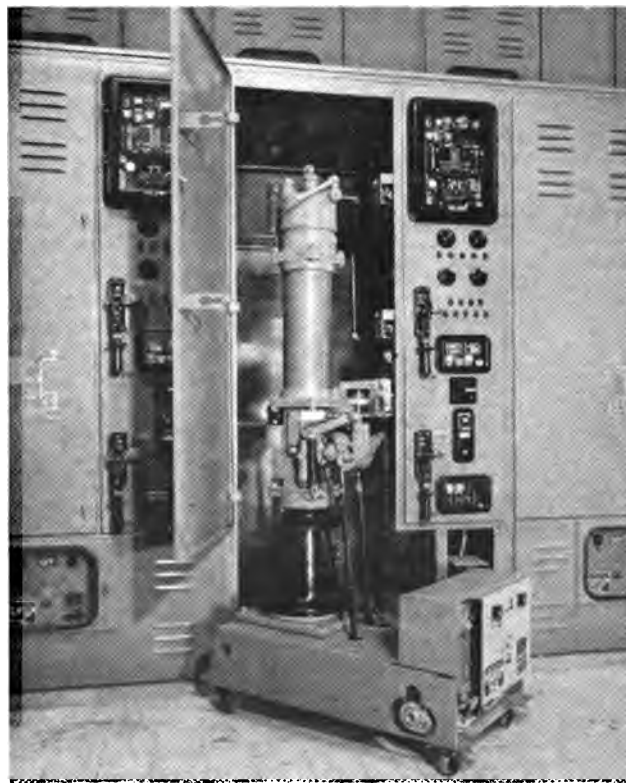


Fig. 5. Air-insulated switchgear made by Fullers with oil-minimum circuit-breaker wheeled out for inspection

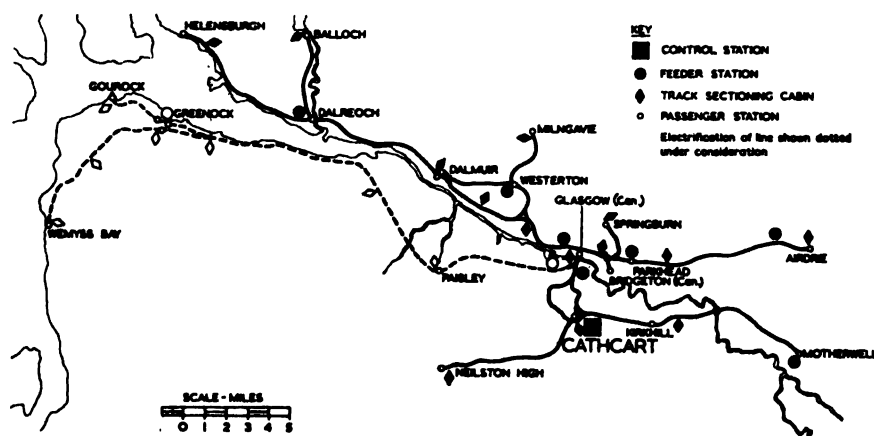


Fig. 6. The extent of the Glasgow suburban scheme, which has a high proportion of 6.25 kV lines

300 MVA type the oil content is only 5.2 gallons. The circuit-breaker is wheel-mounted with flexibles for the control circuits and can be easily withdrawn from its cubicle for inspection. The principle of the oil minimum breaker is shown in Fig. 3. In the arc contraction chamber, a piston moves downwards under the gas pressure of the initial arc. By differential action, this movement creates a pressure which drives a flow of clean oil radially inwards towards the arc, thereby contracting and cooling it.

Auto-reclosure is arranged to give a single closure after a fault clearance on the outgoing side with a time interval adjustable from 5 sec to 20 sec. An unusual feature of the circuit-breaker is the inclusion of a direct-acting over-current release which actuates the tripping latch directly without energisation of the trip coil, giving very rapid fault clearance in between 3.5 cycles to 4 cycles.

The equipment provides for suitable current transformers, relays and voltage transformers. Voltage transformers have the space between windings and the porcelain housing packed with quartz sand, so reducing the oil content to only two gallons.

Oil-Insulated Switchgear

The oil-insulated switchgear is contained in four fabricated steel oil chambers containing isolator, o.c.b., isolator and cable bushing, respectively. The isolators have "on," "off" and "earth" positions. The circuit-breaker includes a special self-compensating interrupter which maintains a consistently low level of arc energy and is therefore suitable for repetitive interruption. Between 10 and 20 short-circuits can be interrupted without impairing the breaker's ability to clear the maximum fault current for which it is designed.

The arc control device is designed to meet the BTC requirements for low-current, low-power factor and over-voltage interruption. Ducting and venting of the oil spaces within the Permal arc control stack are designed to give efficient interruption at low currents. With such currents, the arc traverses a sinuous path as shown in Fig. 3, due to oil vapour and pressure flow. The plate stack is clamped together by four spring bolts. At higher currents, the pressure generated is sufficient to overcome these compression springs and to force the stack plates apart. This automatically increases the venting space to an extent depending on the current flowing. The arc now follows a predominantly straight path and the extinguishing effort is reduced so that the contact gap exceeds its minimum stable breakdown value before the arc is extinguished. The arc energy is low and therefore risk of current chopping with subsequent restrike is eliminated. Similar switchgear with

current rating of 1,200 A has been developed for the 6.25 kV substations.

Booster Transformers

To reduce telephone and signalling interference, booster transformers and return conductors have been installed. The cost of these methods is estimated at 5% of the total fixed equipment cost. The booster transformer has its primary in series with the overhead line and its secondary in series either with the track or a special return conductor. The transformers have a unity ratio and are in effect current transformers confining the current to the desired paths.

Auxiliary Supplies

Auxiliary supplies for heating, lighting, battery charging and signalling standby supplies are obtained from 25 kV or 6.25 kV/625/240 V transformers. The 625 V output for signalling is taken through a Brentford voltage regulator, designed to maintain the output voltage to within $\pm 3\%$ for an input voltage variation from -30% to $+10\%$. The transformers are protected by a fuse unit with isolators and air-insulated h.r.c. fuse. The signalling supply is normally obtained from the local medium voltage town supply through 415/625 V step-up transformers.

Signalling supplies are generally taken at 50 c/s, but for the Great Eastern conversion and areas in the Eastern Region, where d.c. track circuits cannot be used, the signalling supply consists of two separate, fixed-phase, related single-phase supplies at 83 $\frac{1}{3}$ c/s obtained from frequency converters. A standby supply from a diesel generator comes automatically into use within four seconds in an emergency.

Other auxiliaries include 25 kV/110 V reference voltage transformers for the track distance impedance protective system and battery installations for circuit-breaker operation and supervisory control.

Remote Control of Power

In accordance with British Railways standard practice, all circuit-breakers are remotely controlled from centrally situated control stations. A voice frequency system is employed to avoid interference from the traction equipment.

The area covered by a control room may cover 600 track miles and control up to 50 track-side stations. For the London Midland scheme there are four control rooms and the Eastern and Glasgow schemes have two and one, respectively.

Two schemes are used, devised by STC and AT and E, which are arranged to be compatible. In the control room, a mosaic mimic diagram represents the track layout with circuit-breakers and motorised switches indicated by rotatable discrepancy switches. Adjacent lamps represent circuit-breaker operation, accepting and cancelling alarms and checking indications. Other lamps give warning of six types of fault including loss of standby supplies and Buchholz relay operations.

The essential difference between the two systems is that STC use frequency modulation to superimpose the station identifying and control signals onto a single basic frequency, whereas the ATE system uses two frequencies, one common to all stations and the other particular to the station to be controlled.

Signal transmission is over pilot wires, two for outgoing signals and two for incoming signals, and one set of four pilot wires can provide complete supervisory control for up to 12 stations. The pilot lines are duplicated and additional wire pairs are provided for telephone speech circuits.

The conference continues and further reports will follow.

Conference Opening

"A landmark in railway history," was how Sir Brian Robertson, chairman of BTC, described the Electrification Conference in the course of his opening address. Over 40 papers are to be discussed at the conference, which is being attended by more than 400 delegates representing 40 railway administrations from the USA to Russia.

Sir Brian said that a.c. electrification is incomparable for providing a competitive system of traction given certain conditions, notably a consistently high traffic density. Such conditions apply on certain sections of British Railways, although they are accompanied by many engineering problems as a result of our loading gauge limitations. How these problems had been solved would be apparent during subsequent sessions of the conference. The decision to use a.c. rather than the well-tried d.c. 1,500 V system was taken in the full knowledge of its attending technical difficulties, but also in the knowledge that it held greater scope for future development both here and overseas.

Referring to the remarkable achievements of the French railways and commenting on the wide use of a.c. traction in the Soviet Union, Portugal and latterly India, Sir Brian expressed the hope that the conference would provide delegates with a rare opportunity for the exchange of ideas.

In addition to the technical papers presented on Tuesday and today, delegates will be able to inspect progress on the Manchester-Crewe line and in the Eastern Region.

After the address by Sir Brian Robertson, Mr S. B. Warder, chief electrical engineer for the BTC, outlined the reasons for choosing a 50 c/s system. High traffic density is the main justification for electrification of British Railways. Electrification of lightly loaded lines is of little interest since dieselisation offers a more readily available alternative. The Southern Region provides an example of a system where higher traffic density and increasing revenue has been promoted by the system itself. The use of d.c. for main line traction was first considered as a development of the Southern Region type of system, but using an overhead higher voltage scheme. The inflation of the 1950s, however, showed this system to be less economically attractive than had previously been supposed, especially in view of the developments in a.c. traction equipment. The a.c. system is superior in all respects to its d.c. counterpart, bringing economies in capital and running costs. Its development in the last five years, particularly in France, Portugal, Russia and now India, has been spectacular and its adoption by British Railways will have the great advantage to manufacturers of giving them operating and development experience which they can apply to overseas markets.

The electrification programme had already required development of glass fibre and PTFE insulators and had prompted the use of semi-conductor rectifiers for traction applications. Valuable experience was also being gained in the testing field by the introduction of data recording and processing techniques.

On Monday afternoon the Rt Hon. Ernest Marples, M.P., Minister of Transport, opened the exhibition of locomotives, rolling stock and accessories on display at Battersea Wharf. The exhibition is open to the public from 2 p.m. to 5 p.m. from 3 to 9 October.

Financing International Electricity

DETAILS of loans by the World Bank (The International Bank for Reconstruction and Development) for electricity supply are given in the fifteenth Annual Report of the bank covering the year ended 30 June, 1960. During this period, loans for power projects were made to Chile, Colombia, Honduras, Italy, Nicaragua, Norway, Pakistan, and Peru. Total value of these loans was \$182,800,000, bringing total outstanding loans by the bank for generation and distribution to \$1,605 million, out of a grand total in all categories of \$5,068 million. \$441 million of the electrical total are invested in the Middle East.

Besides providing loans for specific schemes, the bank staff have been active in providing technical assistance for a number of projects. For example, in the United Nations Special Fund a survey has been carried out of the electricity board needs and potential of Argentina. This was conducted by consulting engineering firms under bank and Argentina Government supervision. In Nigeria, the bank is overseeing a survey to ascertain the merits of constructing a multi-purpose dam on the River Niger.

Private Industry

Also published last week was the report of the International Finance Corporation set up by the World Bank to encourage growth of productivity by private enterprise in the less developed areas of the world. Amongst the investments made during the year was \$960,000 Magrini Meridionale. This concern is to build a plant near Naples for the manufacture of low and medium voltage circuit-

breakers, largely under licence from Westinghouse International. None of the other new investments of the Corporation had a direct electrical interest.

Power Loans

Details of the new World Bank schemes are as follows:
Iran. \$42 million for multi-purpose scheme in Khuzeestan; 620 ft high dam, 130 MW capacity.

Pakistan. \$2.4 million loan to Karachi Electric Supply Corporation for 14.7 MW diesel power plant to give rapid reinforcement of supply pending expansion of steam plant.

Italy. \$40 million loan for SENN 150 MW nuclear power station on the Garigliano River, between Rome and Naples.

Norway. \$20 million loan for two hydro stations of 168 MW combined capacity in mid-Norway.

Chile. \$32.5 million covers 280 MW hydro scheme near Santiago and thermal station at Huasco, Northern Chile, of 15 MW capacity.

Colombia. \$17.6 million and \$25 million, respectively, for 117 MW additional capacity in Bogota and varied additions in the Cauca Valley, one of the most rapidly growing industrial and agricultural areas of Colombia.

Honduras. \$8.8 million for first stage of 27 MW hydro scheme.

Nicaragua. \$12.5 million for 50 MW hydro plant and transmission lines to supply Managua, the capital of Nicaragua.

Peru. Help towards 260 MW 10-year programme for Lima area.

Safety in industry

ELECTRICAL INSPECTORS OF FACTORIES SURVEY 1959

DEVELOPMENTS in electrical engineering practice and their effect on safety are discussed at length in the newly published report of the Senior Electrical Inspector of Factories for 1959.* Such topics are dealt with at greater length than was customary in the past, although the report includes the usual analysis of reportable accidents. One result of the changed emphasis is that electricity supply receives greater attention than has sometimes been the case in the past.

One of the supply engineering topics discussed is developments in alternator excitation. The particular problem of concern is the increasing difficulty of suppressing the field of a large alternator sufficiently quickly to ensure safety in some circumstances. The inspector instances the case of a fault in a solidly-connected auxiliary transformer, for which suppression of the alternator field is the only possible remedial action. In such circumstances considerable damage may be done and danger may arise. "This problem should be seriously re-examined." Hope of improvement is seen in the development of excitation systems using silicon rectifiers.

In an extended discussion of progress in electrical insulation, considered from a safety aspect, the inspector considers the disadvantages, as well as the advantages, of mineral-insulated metal-sheathed cables. Saying it is excellent where there is a fire hazard, he warns that it has weaknesses which may give trouble if suitable precautions are not taken. Resistance to puncture by transient over-voltages is lower than rubber and the sheath may work-harden and crack if subjected to repeated flexing or vibration. In this case the insulation is liable to absorb moisture and fail quickly. Joints, if not well made, may also be points of weakness.

Concern is expressed at the increasing voltage used for arc furnace operation. Latest furnaces will operate at some 560 V maximum across phases, giving a possible shock voltage of over 320 V. This points the need for extra precautions to safeguard staff tending furnaces, if hand tools are to be used.

The inspector strongly criticises architects for their failure to provide adequately for electrical safety in buildings. He remarks that it is not uncommon to find that space allocated for a lift control room in a large building is insufficient to allow for the clearance and working space necessary to comply with the Electricity Regulations under the Factories Act. Not infrequently, access is unsafe and total space allotted to the substation is entirely inadequate.

Accident Review

In the review of electrical accidents, attention is given to subsidiary causes, shown in Table 1. These figures emphasise how essentially dangerous is testing. (A full analysis of electrical accidents in terms of apparatus involved was given on p. 428 of 22 September issue.)

* Electrical Accidents and Their Causes, 1959. Published by HMSO, 5s 6d.

Considering accidents in electricity supply, two aspects of human error are emphasised. One is an assumption that a skilled or semi-skilled operator knows more of the technical situation than, in fact, he does; and secondly, an assumption on the part of a junior engineer that experienced persons working under him, and for whose safety he is responsible, are in a better position to know and avoid danger than he is himself.

Table 1. Contributing causes of reportable electrical accidents, 1959

	<i>Fatal</i>	<i>Total</i>
Failure or lack of earthing	4	76
Testing	3	67
Ignorance, negligence, forgetfulness and in- advertence	22	316
Accident resulted from the fault of a person other than the injured person	6	105
Working on live gear deliberately	2	81

There is concern throughout the report with failure of oil-filled isolators or isolating switches when closed onto a faulty network. Such failure has caused fatalities, and the inspector feels that accidents will continue, in spite of all reasonable care, until isolators which have not adequate making and braking capacities have been eliminated and properly designed isolating switches installed in their place.

A similar problem occurs on medium voltage for factories, but there is greater technical difficulty in finding a solution there, since it is not easy to design a simple isolating switch of reasonable dimensions which will break heavy currents and will be capable of making the prospective short-circuit current and breaking load current. A possibility is for a simple isolator to be mechanically interlocked with a circuit-breaker, so that it can only be opened or closed when the circuit-breaker is opened.

Accidents continue to be caused by contact of cranes with overhead lines. There were eight such incidents in 1959, with eight more cases of direct contact by people or materials and tools. Altogether, there have been 86 accidents of this nature in the six years 1954-59, and 36 fatalities. "Most of these accidents could have been prevented with a little care and in many cases there was gross negligence."

Portable Tools

There is the usual discussion of accidents caused by portable tools. The inspector suggests that a useful degree of protection, which would prevent many of the accidents that have occurred, could be provided by insulated handles used in association with double pole switches, fitting of which is now becoming standard practice with British portable tools. The point of using a double pole switch is that connection with the supply will be cut off even if the conductors are reversed and switches in the wrong wire. Of course, such developments would not give full protection, but it would help men to get free and release the tool in cases where there is no one at hand to switch off when a fault occurred.

Saving London's legs

B.R. INSTALL FIRST MOVING PAVEMENT IN U.K.

EASIER travelling for Londoners who use the inter-connection between the Southern Railway and LTE underground stations is assured by Britain's first moving pavement, opened last week by the Lord Mayor. It is an Otis Escalator Co. double "Trav-o-lator" installation, electrically powered, which can carry 10,000 people an hour along a 297 ft long one-in-seven incline. Including short horizontal lengths at beginning and end, each travelling platform is just over 302 ft long and 40 in. wide.

Each Trav-o-lator strip consists of 488 individual platforms, each 40 in. by 16in., surfaced with special quality aluminium and riding on ball-bearing wheels of phenolic and canvas materials. Platforms are connected together and driven by two roller chains and can travel at 180ft/min.

Electrical Drive

AEI Motor and Control Gear Division acted as sub-contractors to Otis Elevator for the electrical equipment. The main drive comprises two variable speed a.c. Schrage commutator motors, each 85/42½/5 h.p. rating at speeds of 710/335/140 r.p.m. These motors run at the first speed at full speed, at the second when idling, while the third is used for inching. An over-speed of 840 r.p. is available for testing the over-speed governor, which is one of several safety devices provided with this installation.

A photo-electric control is provided to govern the speed of the moving platform. It drops from full to idling speed if a pre-set time elapses with no-one on the platform. There is also overriding control so that if a platform becomes

overcrowded the platform can be slowed to restrict rate of arrival of passengers.

Motors are supplied at 415 V, and the switchgear is by George Ellison, comprising two "GEO" 400 A circuit-breakers, four fuse-switches (one 300 A and three 150 A) and two 600 A t.p. and n. link isolators.

The motors drive through a high-efficiency multi-start worm, the motor room being beneath the top landing. The coupling between each platform and motor forms the drum of an electro-magnetic brake, which is electrically held off and provides smooth stopping of the platform if necessary. All magnets are operated from a d.c. supply rectified from the main a.c. supply.

Contact-type control gear is used for the installation, and brush shifting on the main motors is controlled by pilot motors.

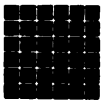
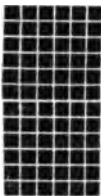
Lighting

Continuous fluorescent trough lighting is used in the Trav-o-lator tunnel at deck level, with a central trough of fluorescent lighting in the ceiling at the foot of the Trav-o-lators. Provision has also been made for installation of special lighting to obviate any glare from the aluminium "travel strips." Below each platform are fixed lights and socket-outlets for maintenance purposes, both supplied at 50 V.

One of the many notable features of the new installation is its use of John Summers' "Stelvetite" plastics-coated sheet steel for lining the tunnel in a blue-brown finish.

Below, General view of Bank "Trav-o-lator" showing lighting arrangement. Right, George Ellison switchgear for the main drive, which is located through the door on the left





Supply critique

SIGNIFICANT ASPECTS OF E.C. AND C.E.G.B. REPORTS

IN many ways the financial year 1959-60 was a prosperous one for the supply industry. The reports published last week, and reviewed in outline then, and in more detail as regards the area boards on a later page in this issue, show demand leaping ahead and engineering technique keeping pace. Yet since the reports were completed the boards have become committed to higher payments for wages and salaries and for coal. Tariffs are being increased. A closer study of the reports extends the background to this move and raises some further questions about the prospects for electricity supply.

Capital Plans

Perhaps the key characteristic of the industry is its continuing expansion; indeed, accelerating expansion. Every year a high level of capital investment has to be arranged; last year, after allowing for the effect of £13.4 million drop in working capital (largely through increased indebtedness), the money that had to be found on capital account for the industry as a whole was £304.5 million (CEGB £200 million). Table 1 shows percentage-wise how it was obtained.

Table 1. Where capital came from, 1959-60

	Industry, Consolidated	CEGB	Area Boards
Capital required	£304.5m.	£200m.	£104.5m.
Consolidated surplus ...	8.8%	2.7%	20.4%
Depreciation, etc. ...	31.8%	29.6%	35.8%
Sales of fixed assets, cons. contbns., etc. ...	3.0%	0.6%	7.8%
External borrowing ...	56.4%	67.1%	36.0%

From the table, the relatively small part contributed overall by surpluses stands out; but against this it has to be remembered that only surpluses are readily under control of the boards; through their tariff policy and through increasing efficiency of operation. As discussed later, the book surplus of the CEGB was reduced, and the contribution from depreciation increased, by yet another change in depreciation practice.

The declared aim of the supply industry is to finance from internal sources 48% of all its capital requirements over the seven years from April, 1958, to March, 1965. In the first of the years the proportion achieved was 47.4%; in the year just ended, 43.6%. Although this is not greatly removed from expectation when the original estimates were made, the probability that the investment programme for 1960-61 will be above that originally agreed underlines the need for increased revenue margins if progress to the 48% level is to be made.

Increased Programme

One of the important announcements in the reports this year is that of a supplementary programme of 650 MW sent out capacity to be installed in the calendar year 1961 additional to a main programme of 1,727 MW. The basis for the decision to increase the programme by this amount is one of the periodic reviews that are made of overall forward plant programming. It has been concluded from this review that, while estimates of national demand have been reasonably valid in the short term, longer-term estimates have shown a persistent tendency to underestimate.

The increase in estimated demand for 1964 resulting from the revision is no less than 1,200 MW (about 34% of the balance above 650 MW s.o., which is to be added to the programme in the form of two 350 MW coal-fired units to be met by prolonging the life of some old plants). Thus the under-estimate is going to be expensive in costs, though it has saved capital in the past through postponing installation of new plant.

By 1964, total capacity of the CEGB system will be 34,833 MW s.o., of which 5.2% should be nuclear (1,800 MW).

Programmes in the CEGB report do not run so far ahead as they have previously. This is because of such in the period required for planning and building a power station. Decisions about provisional programmes are being delayed so that the latest load estimates can be used. For example, the 1965 programme will not be settled until later this autumn, although it is known that it will include the first supercritical set and also the first 500 MW single-shaft machine.

Technical Advance

The CEGB report discusses the complexities of pressing forward with technical advance at some length, with particular reference to the decision to go to supercritical steam conditions. Estimates obtained for a 375 MW unit operating at 3,500 lb/sq in., 1,100°F and 1,050°F relative humidity suggested that the overall cost of producing electricity would be about the same as for a 350 MW subcritical unit. This result has to be seen against the conclusion that a 500 MW single-shaft machine is practicable and that it should give the same fuel cost as for a 350 MW machine but lower capital costs. The conclusion reached in the report is that prospects of general employment of supercritical steam conditions will be dependent on development of materials and techniques enabling plant costs to be reduced. Orders for two units in this class have to be seen as encouragement for such development.

The step upwards in size and pressures for general plant is matched on the transmission side by the beginning of work for 550 kV transmission and the rapid advance to trial working at 380 kV.

What the advance in designs means in savings is vividly presented in the opening chapter of the CEGB report. While a 30 MW turbo-alternator weighs about 8.3 tons/MW, a 350 MW design will weigh only 3.1 tons/MW. For a 180 MW station housing six 30 MW sets, the building volume is 39.4 cu ft/kW; for a 1,100 MW, two-set station only 22.1 cu ft/kW. Stations being planned may be built for only £40 to £45/kW.

Generation Costs

An important element in the industry's overall result for 1959-60 was the substantial fall in generating costs, coming partly from a 5.5% decrease in average cost of coal as delivered to power stations, and also from an improvement in thermal efficiency from 26.10 average to 26.53%. Both these figures are a little misleading when financial savings are being considered. The coal figure requires correction from the aspect that the calorific value was substantially lower; and attention is also required to the increased use of oil, which was cheaper. Working on heat content, fuel cost fell by 4.8%. The efficiency factor needs conversion to a percentage improvement with respect to the previous year's figure. This works out at 1.6%. Combined, the two figures give an improvement of 6.5% in electricity generated per pound spent on fuel.

Load Factor

There is concern about falling load factor in some of the area board reports; but it seems that the fall from a recorded 47.0% in 1958-59 to 46.5% in 1959-60 was a reflection of the difference in the weather in the two years. Had the weather been "standard" in both years, the comparison would have been an improvement from 46.5% in 1958-59 to 47.0% in 1959-60.

Depreciation

The year saw several changes in depreciation practice, which in turn led to book-keeping alterations that disguise in some ways the significance of the figures in the accounts. The most important change was made by the CEGB. Whereas the practice has previously been to defer depreciation provisions for new generating plant until it is commissioned, the new basis is to base depreciation payments on expenditure incurred up to the end of the previous year. The result of this was an extra £4.5 million on a revenue account item which, at £57.5 million, represented 15.1% of the Board's turnover.

Area boards made various minor changes in depreciation provisions. They already use the basis to which the CEGB has now changed for generating plant. For the industry as a whole depreciation takes 16.9% of turnover.

Contracting and Fittings Sales

An increase of £2.9 million in the figure for surplus on contracting and sales of fitting activities, which was £6.0 million, was the outstanding feature of area board trading, and deserves closer attention.

The first fact that stands out from the figures is that change in hire-purchase sales had most to do with the increase. Turnover was up £12.8 million at £69.5 million. Of the increase, only £1.3 million is represented by cash and normal credit sales; £11.5 million is extra trade conducted through h.p. agreements and the like. Turnover on electrical contracting has hardly changed at all, only £0.3 million up at £18.5 million, but sales of fittings is £12.6 million up.

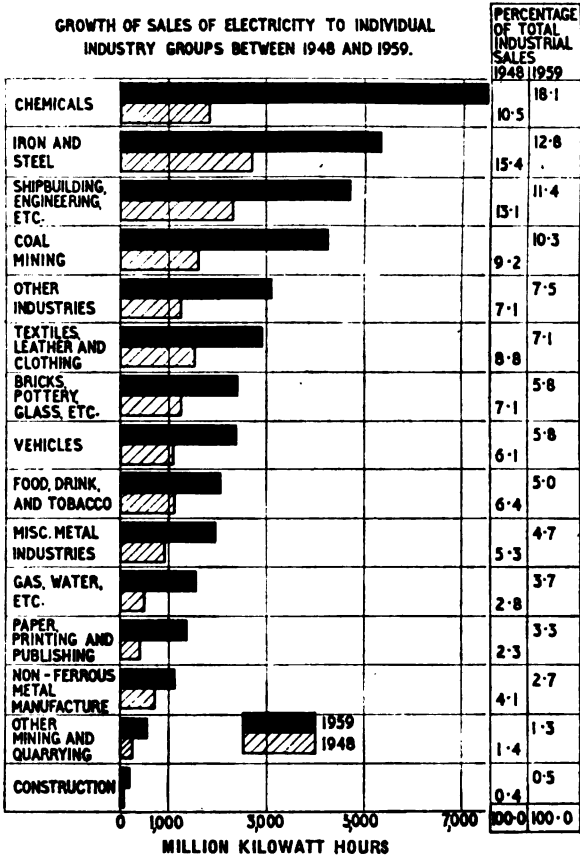


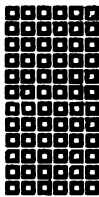
Fig. 1. How sales of energy have increased since vesting day

According to the estimates of the boards, this extra business has been carried out with an increase in direct costs of £9.7 million, and of £1.2 million in indirect costs—things like salaries, transport, publicity and a proportion of the boards' general charges. It is the figure obtained after these costs have been allowed for that appears in the revenue account. But a separate estimate is made of the costs of rent, rates and insurances of showrooms so far as they are attributable to sales of fittings and contracting. The amount concerned is relatively small, and the corrected surplus is £6.0 million.

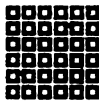
It is not always realised that the turnover figure for the contracting and sales of fittings work does not come directly into the published revenue account, which thus understates each year the real turnover of the industry. Overall, the high rate of 8.6% of turnover was earned during the year in this business, compared with 5.5% the year before, and 4.8% overall in the electricity supply.

Area Board costs

Many of the costs of the area boards continue to fall. Distribution cost for 1959-60 was down to 0.092d/unit, with a range from 0.074d in the NWEB to 0.146d in London. Consumer service at 0.047d/unit varies from 0.034d/unit in South Wales to 0.086d in London, although apart from London and the SWEB (0.068d) costs are grouped closely, with the next highest 0.049d. Meter reading, billing and collection has been brought down to an average of 0.031d/unit, with South Wales lowest at 0.021d. Administration is now only 0.033d/unit, and is spread from 0.026d to 0.058d (SWEB). This last category in the first of the nationalised reports showed a range from 0.070d up to 0.169d, at the price levels of 1948-49.



Area board review



1959-60 ANNUAL REPORTS SURVEYED

THROUGHOUT the area board reports published last week runs concern about quality of supply. In discussions of capital requirements, the need for reinforcement looms large, with evidence of concern to give better continuity of supply through extending such available techniques as high-speed reclosing circuit-breakers.

Engineering

The SEEB, for example, are one of many boards planning more installations of auto-reclosing switches, lightning arresters and surge absorbers. They are also extending the use of mobile generators so that essential supplies can be restored temporarily. In another facet of the same idea, the SWEB have brought into use a 33 kV portable cable for temporary and emergency connections, together with appropriate terminations and supporting rig. This is additional to the now-proved 11 kV cable equipment.

EEB contribution to the problem has included development of automatic fault alarm systems from unattended substations, using the public telephone system. This board voice the general concern, saying that with the area's financial position improved and a substantial proportion of new finance being provided from internal sources, they feel better able to meet expenditure needed to provide a higher standard of reliability.

Impressive evidence of the value of auto-reclosing in rural h.v. lines comes from the MEB. Analysis of 1958-59 experience has shown that a line with auto-reclosers has only 10% of the lightning interruptions per 100 route-miles that occur without such protection.

Apart from continuity of supply, there is the question of quality, especially in terms of voltage at consumers'

terminals. A trouble referred to by several boards is that of obtaining substation sites essential to enable reinforcement to proceed even when the necessary capital has been allocated. Some boards are experimenting with buried transformers to ease this situation, but the EEB comment that the high costs of such methods, plus the presence of apparatus of other statutory undertakings, limits the use of the technique to a few special cases. The SEB, faced with severe space restrictions in one transformer chamber, have had to resort to cold-rolled steel in a special single-phase design to give 400 kVA capacity in space usually occupied by a 300 kVA unit.

The Manweb Electricity Consultative Council (ECC hereafter in this survey) invited the Board to use the good offices of its local representatives to ease the obtaining of substation sites and wayleaves. Amongst other consultative councils to concern themselves with engineering topics is the SWECC, who express concern that there is still no decision at national level about earthing; they feel it is time there was an answer to this, and go on to remark that the problem is particularly difficult in the southwest, and that consumers look to the Board to provide the answer.

Operationally, the year was relatively easy, with few bad storms or natural calamities. However, even the fine dry summer brought some problems of its own. Special arrangements had to be made for the NEEB 66 kV system because shortage of cooling water restricted generation at the North Tees station; and the YEB experienced several serious interruptions to supply because the sustained drought deprived insulators of their normal washing by rain.

Electroheat for industry figures largely in newly given industrial supplies which are reckoned worthy of mention in individual reports. A comment on the growing use of electric steel furnaces is the need for the YEB to arrange for a supply of 40 MVA for manufacture of electrodes for arc furnaces.

Reporting continued satisfactory service with their single-wire earth-return line, the SEB say the technique is now thought unlikely to find widespread application. Another out-of-the-ordinary technique, peak load generation by gas-turbine generator at a SWEB station, has given every satisfaction, and a second set is being installed. This Board is also installing additional diesel generating capacity in the Isles of Scilly.

Two boards comment on the changes in organisation of the manufacturing industry, in its effects on prices. Lower prices for cables and transformers resulted so far as the LEB were concerned. The MEB comment that amalgamations tended to reduce the number of available suppliers, but made possible the placing of larger orders, to mutual advantage. Incidentally, the LEB express the opinion about plastics-insulated cables, that they offer "no saving in price, and disadvantages in use."

Greater use of surge diverters rather than co-ordinating gaps for 66 kV substations is reported by the YEB, who

Table 1. Area Board Results compared with 1958-59

Area Board	Cost of Electricity		Contracting, etc., account % of Turnover	
	Overall d/unit sold	Running charge in BST d/unit	Indirect costs	Surplus
London	1.293	0.671	14.8	9.6
S. Eastern	1.324	0.783	12.9	5.7
Southern	1.238	0.642	14.5	11.0
S. Western	1.233	0.747	15.9	8.2
Eastern	1.163	0.595	15.4	10.7
E. Midlands	1.184	0.703	18.0	6.7
Midlands	1.129	0.624	15.8	8.8
S. Wales	1.197	0.746	17.1	7.5
M. & N. Wales	1.169	0.614	15.5	9.1
Yorkshire	1.210	0.725	15.8	7.2
N. Eastern	1.014	0.515	14.0	9.5
N. Western	1.038	0.588	16.4	6.0
London	1.052	0.563	15.8	8.9
S. Eastern	1.081	0.538	18.0	5.5
Southern	0.883	0.534	17.7	6.1
S. Western	0.921	0.597	14.4	7.7
Eastern	0.984	0.558	14.0	9.6
E. Midlands	1.049	0.664	15.6	5.7
Midlands	0.914	0.469	14.1	9.7
S. Wales	0.963	0.557	17.1	4.7
M. & N. Wales	0.981	0.545	10.1	12.0
Yorkshire	1.064	0.664	12.6	7.8
N. Eastern	1.053	0.563	14.4	9.2
N. Western	1.090	0.656	16.4	5.4

1959-60 figures bold; 1958-59 ordinary type.

Table 2. Area Board Commercial and Engineering Statistics, 1959-60

Area Board	Consumers at 31.3.60 x 1,000	Increase during year x 1,000	Net maximum demand MW	Maximum demand 1958-59 MW	Load factor %	Increase in circuit miles of h.v. lines and cables	Increase in circuit miles of l.v. lines and cables	Consumers changed to standard a.c. supply
London	1,772	12	2,489	2,310	38.1	126	168	58,972
South Eastern	1,253	32	1,645	1,397	39.9	288	236	26,488
Southern	1,388	43	2,093	1,827	41.2	583	365	9,947
South Western	771	18	876	787	46.4	592	200	3,375
Eastern	1,789	45	2,495	2,275	41.8	674	374	11,053
East Midlands	1,335	31	1,931	1,796	45.5	351	335	19,188
Midlands	1,424	32	2,511	2,368	45.9	533	292	23,035
South Wales	639	14	1,022	991	62.6	738	128	5,969
Merseyside and N. Wales	926	21	1,294	1,211	52.6	532	254	8,137
Yorkshire	1,517	25	2,292	2,168	49.6	488	285	25,775
North Eastern	1,039	21	1,203	1,133	53.7	480	167	6,444
North Western	1,646	29	2,415	2,257	46.4	425	230	12,567

say the change reduces the danger of simultaneous flash-over of gaps at duplicate substations.

Research

Area board research is co-ordinated through the Electricity Council, and the general outlines of the work given in the EC report, summarised last week, are reflected in individual board reports. For example, the widespread work with plastics-insulated mains cables and services comes into this category. There is also much attention to the problems of supplies for arc furnaces, in so far as they may cause voltage fluctuation. However, there are some individual research projects which deserve closer attention.

Use of series capacitors in lines is being tried by some boards. The NWEB have a series capacitor in an attempt to reduce voltage flicker on a 19 mile-long 33 kV line supplying an arc furnace at Alston, Cumberland (1,800 kVA demand). Shunting resistors were provided during the year on a 6.6 kV series capacitor which the YEB have been operating in an attempt to deal with voltage fluctuation caused by a spot welder installation. The resistor solved difficulties that had arisen with the switching of the capacitor and its associated distribution transformer, but the high harmonic content of the magnetising inrush current each time the welder is switched on produces a voltage drop which is not appreciably affected by the series capacitor, so this has been withdrawn from service. Better success has been experienced by the NEEB, who have a series capacitor on a 11 kV line. Spark gaps of changed design installed on this have been found to operate satisfactorily without erosion.

Transformer noise is worrying boards, increasingly so as the finding of substation sites becomes more difficult. SWEB work on the problem has included sheet metal cubicles for transformers, lined with sound-absorbing material. Another widespread problem is that of providing meter reading facilities without access to the house. The EMEB has designed a service unit for building into the outside walls of private dwellings, permitting outside meter reading. They are reported to be checking on manufacturing potentialities and cost. In the YEB there have been experiments with providing a cupboard for meters and services in the porch of a house. The arrangement is reported to have become increasingly popular.

Earthing at substations where soil conditions are unfavourable concerns the NEEB. They have been conducting trials with what is described as a "mineral material" in the hope of reducing resistance around earth electrodes, but results seem conclusive that this is not the answer to the problem.

Apart from the work on plastics cables, work is proceeding on cable heating, with the SEB involved in terms of

moisture movement around p.i. cables installed in the ground. Flat 33 kV oil-filled cable, which does not need oil tanks along its route to maintain pressure, has been installed by the EEB. Mechanical jointing of cables is the subject of LEB trials. In the overhead line field, the SWEB report investigations continuing on problems of vibration of aluminium alloy conductors and "into possible use of preformed line products."

There is much utilisation research work on heating, and many floor-warming and block heater installations are being instrumented to give precise information on effectiveness and electrical load characteristics. Amongst other work is testing of ceiling heating for domestic premises by the NWEB, who have also erected two small identical buildings to study the behaviour of floor-warming in direct comparison with conventional electric heating systems.

Commercial

Active load development over the whole field, rather than a few sparkling successes, marks the reports of the commercial departments of all the boards. Much of the work has been concerned with off-peak loads, which are treated later in this review; but the LEB make a special point of mentioning that the accent in their commercial work during the year was on all-the-year-round and summer use of electricity. Of course, sales of fittings reached new record levels during the year, though there was no remarkable expansion in contracting work—but Manweb report more installation work carried out for consumers than in any previous year.

An interesting point about what determines "class" of consumer for tariff purposes is raised in the report of the EEOC. A children's home has been ruled non-domestic, but the decision is to be reconsidered "as soon as results of full tests to ascertain characteristics of electricity consumption in homes of this kind" are available. Also concerned with consumer consumption characteristics were the South Wales EB, who have carried out a detailed study of cost of supply to various classes of consumer. This has revealed that consumers with low load factor have been making insufficient contribution to the cost of supply.

Special interests of individual areas stand out in the commercial sections of reports; the NWEB comment on a 34% increase in sales of electric catering equipment, "particularly promising with fish frying ranges." Special attention to electro-heat has been paid by the MEB, with evening lectures organised in conjunction with the local college of technology. Progress with electrification of collieries, particularly coal winding, attracts comment in the NEEB report. Local preference even at district level is given by the EMEB as their reason for not being in favour of bulk buying for domestic appliances. They think local

managers are better able to cater for varying local tastes and habits by purchasing supplies themselves.

There is widespread reporting of running down of hire schemes of various kinds, and the NWEB is to abandon its scheme for hiring electric motors. This same Board reports that its "Electricity comes to Town" travelling exhibition proved more successful as a selling medium than its "House of the Future" predecessor, although the latter attracted larger audiences.

Off-peak

Almost every board reports success with off-peak heating, and it is possible only to select some of the typical comments and the more significant statistics.

A noticeable trend towards use of electric floor-warming in domestic premises is noted by the LEB, who had 1,300 dwellings connected by the end of the year and 5,000 more under construction. Total floor-warming load of the SEB at the end of the year was well over 10 MW, and it was growing rapidly. This Board has also more than doubled block storage heater load in commercial and industrial premises since 1957, and is approaching the 30 MW mark.

Table 3. Rural Electrification Progress

Area Board	Number of farms in Area	% connected at 31 Mar. 1960	Average consumption per farm consumer kWh
London	82	100.0	7,927
South Eastern	14,400	82.5	9,368
Southern	25,776	88.7	9,472
South Western	31,000	67.0	5,840
Eastern	31,600	82.6	7,510
East Midlands	27,400	92.6	7,109
Midlands	26,600	83.5	7,475
South Wales	23,500	63.1	4,025
Merseyside & N. Wales	33,400	71.5	4,529
Yorkshire	21,291	93.6	5,898
North Eastern	18,838	81.6	5,101
North Western	24,505	87.5	7,456
England and Wales ...	278,392	80.7	6,739

A more sober note about the effect of such off-peak loads comes from the EEB, who point out that although the 17 MW of off-peak heating load added during the year was double that of the previous year, ten times that would be needed to improve the load factor by 1%. Block storage heaters and floor-warming together accounted for over 8 MW of demand newly connected to the NEEB system during the year—including block storage heating for a lighthouse. The total of new connections included 160 flats and 60 houses, and the Board report negotiations complete for installations totalling ten times as many. YEB figures show 1,636 dwellings using floor-warming by the end of the year, and during it 92 commercial and industrial consumers installed floor-warming with aggregate load 3.5 MW.

In the reports, it is especially noticeable how floor-warming is making progress in churches, for which early estimates were that it would not find great application. The concern about the effective ban on block storage heaters for domestic premises, which is imposed by purchase-tax regulations, is discussed by the EMECC. They raise the question of the effort needed by the supply industry to convince manufacturers that there might be a large enough demand for a heater suitably designed for domestic premises. The Council feel this might be so, even if purchase-tax on all block heaters had to be accepted. They continue "the supply industry will obviously have to

prove its case for the extended use of these heaters. To do this it will be necessary to carry out further experiments with a redesigned block heater more suitable for domestic premises than the present industrial type."

Apart from heating of buildings, there is interest in su off-peak loads as road heating and electrode boilers for heating swimming pools, operating only off-peak. Although there is the possibility of interruptible loads to be exploited, The NWEB reports 100 MW reduction of its peak load through special interruption agreements with consumers.

Administration

All the reports discuss the recommendations of the W Committee which studied co-operation between gas and electricity boards, and there is special attention to meter reading. Many boards are interested in experiments with estimating consumption for some quarters, and bill consumers on that basis. The LEB is working on a one-four quarters estimated basis in one district. Manweb is using postal meter reading in some rural areas, considering it better than estimating readings for some quarters—they say they would prefer quarterly visits with estimates when the consumer is out, in urban districts.

The SEB have accepted the suggestion that estimate meter readings for two or three quarters should be offered to credit-worthy consumers "who will undertake to pay without querying the account." EMEB have an experiment with estimating one quarter each year, and initial reaction of consumers has been on the whole favourable. For some rural areas, MEB plan to use estimated readings in alternate quarters. The NEEB is asking isolated consumers to use self-reading meter cards in alternate quarters. If the experiment is successful, it may take in urban areas.

There was only slight enthusiasm for joint activities with gas boards. The EEB say there are no financial savings to offset the administrative disadvantages of joint meter reading in rural areas. However, they are looking at the possibility of according mutual showroom facilities for payment and emergency purposes in small towns where showrooms are not manned all the time. The SWEB is using one gas showroom for payments of accounts.

Aside from meter reading and combined operations there is interest by several boards in the possibility of using digital computers in accounting systems. So Wales EB report that they are introducing an easy payments stamps scheme, with stamps sold at showrooms.

Rural Development

Sales of electricity to farmers during the year went down because the unusually dry summer obviated the need for electrical crop drying. Many of the reports record the hope that the 85% national target for proportion of farms connected will be reached earlier than expected originally. Estimates include SWEB, 1965, three years than original estimate; EEB, 1961; South Wales, 1964, four years less.

Concern with the uneconomic nature of rural electrification is expressed by the SWECC and the South Wales EB. The former say that, although the average revenue per farm has risen to £44 p.a., it is still too low to make rural supply a commercial proposition, while the latter complain at having spent £1 million during the year on rural electrification which will be uneconomic.

Consultative Councils

Something has been said in these notes about consultative councils. Their reports this year are full and provide ample evidence of the steady work they are doing in presenting informed internal criticism.

An example of the concern of consultative councils with subjects other than tariffs is given in the SWECC report. The Council have been concerned about complaints of transformer noise, but they have been told by the board that capital spent on noise reduction like that on undergrounding mains can have the effect of depleting the funds available for rural development. The Council are taking up this point with the Minister.

Consideration has been given by the NWECC to a request by a local authority that the board should officially test all domestic electrical installations when a change of tenancy takes place. The Council did not support this request. They thought it was more important to have an inspection service on which consumers could call whenever they were in doubt about the quality of their installations.

Despite the widespread evidence of concern with such general points, it is the various payments a consumer has to make that received most attention by the boards—plus, of course, the question of priority for connection of rural supplies. There were few tariff changes to consider during the year, and capital charges and details of application of tariffs attracted more attention. The Manweb ECC considered the board's refusal to offer hire-purchase terms to consumers who had a bad paying record, either for h.p. accounts or on their electricity supply. The board would not enter into hire-purchase agreements with consumers for whom cut-off instructions have been issued within the previous 12 months, or those who are paying their accounts by instalments. The ECC were not happy about several

points arising from this practice and discussions were held with the chairman. The outcome was an agreement that the policy should be reviewed after a time.

The South Wales ECC suggested to the board that private contractors were making available deferred payment facilities for wiring work and called for the board to do likewise. However, the board's view was that no evidence could be found to support this contention and that in any case there were financial difficulties and staff difficulties about the idea. The MECC asked their board to look into the possibility of operating an inspection system for domestic installations on a contract basis.

The SECC express concern at the increasing number of representations concerning high consumption. They think the basic difficulty is that consumers are unaware of the amount of energy used by different appliances. A London EB practice of charging a minimum of 7s 6d for attending at consumers' installations to replace fuses, etc., is supported by the LECC.

Most representations by consumers to ECC's are settled at local level and figure in the reports only as aggregated statistics. However, a number of individual cases are reported, of which perhaps the nicest is the consumer who thought he should be allowed to use one immersion heater at night on a restricted-hour tariff and another in the same tank during the day on the standard tariff. He did not find himself supported by the MECC and took his complaint to the Electricity Council, whose views are awaited at the end of the financial year.

DOMESTIC ELECTRICAL ACCIDENTS

SEVENTY-NINE electrical fatalities on domestic premises are described in the annual précis of reports of such accidents that have come to the attention of the Home Office during 1959. Commenting, Mr S. J. Emerson, HM Electrical Adviser to the Home Office, says that the statistics show that the majority of electrical accidents in the home are not caused by faulty or ill-designed apparatus but, rather, by ill-use. An important factor in many accidents is failure to disconnect portable apparatus completely from the supply when not in use, by pulling out the plug.

Five persons were electrocuted as a result of appliances falling into baths. In other bathroom incidents, casualties had touched electric heaters, a convector type clothes drier kept in the bathroom, a record player, and in one case, a portable immersion heater used to heat water in a washing machine. Insulation failure and bad earthing were contributory factors in most cases.

Electric blankets receive special mention in the précis. Burns as well as shock are involved in some accidents. In one case the cause of death was carbon monoxide poisoning and asphyxia due to fumes from a smouldering electric blanket which had been allowed to overheat. Mr Emerson comments that if a blanket is frequently folded in the same place it will eventually break down at the fold and may start to smoulder.

In one fatality an electric kettle developed a high-resistance fault from element to casing. The fault current was sufficient to burn through the earth wire, but not sufficient to blow the fuse protecting the kettle circuit.

Young children again figure in tragic accidents due to improperly wired electrical equipment and particularly when reversible connectors are used, and are left lying about with the far end of the flexible plugged in.

The need for attention to earthing in the interests of workmen is underlined by two cases in which plumbers were killed. One was in the roof space, and stood on some lead-covered wiring, the sheath of which had not been earthed. He received a shock when he touched a water tank. The other man was electrocuted while examining the piping beneath the floor of a house. At the same time, he touched the unearthed lead sheath of a cable which was live as a result of a fault in which a supporting clip had cut through both sheath and insulation.

Attempted Repairs

Accidents when unskilled people try to mend electrical equipment while it is live are perhaps to be expected. Attempts to adjust contact tubes on plugs and connectors are particularly troublesome. A point emphasised by Mr Emerson is that special dangers apply with radio and telecommunication equipment, and it is especially important that such repairs should be attempted only by persons who have adequate technical knowledge.

A final point to note is that the earth continuity conductor of an installation may itself result in danger. A woman was electrocuted when she touched an earth wire while she was washing the floor. With her hands wet, she was abnormally sensitive to electric shock. In another case a fault inside a plug made a connected washing machine alive through the earth wire.

Concluding his covering note, Mr Emerson stresses that experience over the year confirms that electricity is the safest form of power, but that installation and maintenance of electrical equipment should be undertaken only by skilled and experienced people.

NOTES ON WIRING

BY MEGOHM

SOME long time ago I mentioned the appearance of "Observation Platforms" at the big building sites in London, and at once received many letters about their possible uses. It was suggested that the electricians could give conduit laying demonstrations, etc. and there were other suggestions which proved many of my readers have humorous streaks in them. Most of these platforms are on sites which start below the ground and are of little use when the building has reached ground level. However, whilst travelling on an omnibus in the region of London Bridge I was surprised to see at one building site a "Tele-viewing" platform! I really had to look twice for I thought that my eyesight was playing tricks with me. But no, in a darkened area, formed by boarding, a television set was showing a workman toiling away on the roof, or at least the topmost part of the structure. I did not have the time to alight from the omnibus and study the arrangement properly and can only assume that it was a closed circuit television with a camera set up in the structure.

What possibilities such an arrangement offers! I can see all the "wits" getting ideas already. For instance, a receiver in the foreman's office so that he can do his paper work and supervise as well, or even a receiver at head office so that the boss can watch, and learn, what goes on! There are all sorts of ideas flowing through my mind.

One thing I did not find out and that was whether or not there was "sound" laid on for the viewers. Now, there is something which would attract the crowd, especially if electricians today have the same vocabulary as they did when I was young!

Height of Switches, etc.

Recently I commented on a suggestion that the standard switch height of 4 ft 6 in. should receive some thought. This suggestion came from people interested in the welfare of disabled people. Now I see that those interested in the care of the elderly have suggested that more thought be given to the height of switches and sockets in houses built for such people. This I can well understand and I was rather surprised that no mention was made of better switching facilities for such people, a matter which, in my opinion, is more important than the height of switches.

I have looked over a block of maisonnettes intended for the elderly, and the first thing which struck me was the bad lighting in the entrance and staircase and the method of switching the lights. I feel that the lighting in such entrances and staircases should be time-switch controlled. Inside the houses I saw rooms with two doors, but the light was switched at one door only, which meant that the occupier had either to walk in the dark or to switch on another light to enable him, or her, to leave the room safely. I also noticed a tendency to keep the cooker control unit very high. As it was sited over a workbench, even I found it difficult to reach for switching on or off. The unit had no indicator light, which I consider necessary in such situations. In fact, I feel that these lights should be a standard item in both cooker units and water heater switches.

One item in this block of maisonnettes which did appeal to me was that the meter could be read from outside the living premises and, therefore, neither delayed the meter

reader or disturbed the occupant. Also, and this I have nothing to do with electricity but may be of interest to my readers, there was an arrangement where milk, bread, etc. could be left in a small cupboard from outside and removed by the occupant from the inside. The only suggestion I could put forward on this item was that by using electricity the doors could be interlocked so that no danger of a forced entry was present.

Earthing of Sockets

I recently commented on a socket which provided "double" earthing. That is to say, instead of one fixing screw hole having earthing facilities, both fixing holes are suitable for obtaining earth continuity to the metal. This particular make was the first one I had seen. Another manufacturer informs me that they have such a box on the market for some time now. This manufacturer added that it was their wish to see this arrangement become standard, and I sincerely hope that it will. Not a couple of days had elapsed from the time I mentioned this socket when I had a practical demonstration of the need for double earthing. I will not go into details but must just say that had the socket in question been "double" earthed then a friend of mine might have telephoned me in such a panic.

Responsibility on Sites

I have complaints by electrical contractors working on large sites about the attitude of builders to damage done to conduits and cables, etc. The impression that I get from one contractor leads me to think that building workers just ignore other people's material with the result that electricians have to check their installations constantly to ensure that the installation is in order. In particular this applies to situations where conduits are on the shuttering and the concrete is then poured. This results in fairly heavy traffic of wheelbarrows, which can easily knock the conduit out of position if it is fixed in position. Another situation is where conduits have to be cut through floors where conduits have been laid. In many cases the electrician is completely ignored and he is not consulted whether or not there are conduits buried in that area. When the damage has been done the builder, so I am told, refuses to pay for the damage and the electrical contractor is left to hold the baby.

Another complaint is that the main building contractor refuses to off-load any electrical material if the electrician happens to be off the site. I must say at once that I do not come up against any of these problems myself. They only came to light at a site meeting which I attended recently. Certain pertinent questions were asked by the electrical contractor during the meeting which prompted me to question him afterwards. His opinion was that normal 2½% allowed to the main contractor by a building contractor should cover off-loading, etc. and guarantee that any damage done by the builder should be paid by him.

I hope that these complaints are only isolated cases and that good relations are so necessary on all building sites.

OVERSEAS NEWS



from our correspondents abroad

PAKISTAN

Cable Factory

Another cable factory has started up in Pakistan. Known as the Sunshine Cable and Rubber Works, its plant at Tongi, 15 miles from Dacca, in East Pakistan, was formally inaugurated earlier this month by the Director-General of Industries, Trade and Supply, Mr M. A. Karcem Iqbal. Initially, small-sized cable is being produced, but later it is planned to manufacture h.t. cable. The firm claim to be able to meet the entire demand of East Pakistan, with a surplus for West Pakistan. The management is already exploring the possibilities of exporting to the Middle East.

Power Commission

The Pakistan Government is to appoint a Power Commission who, *inter alia*, will undertake a detailed study of the present generating capacity of the country and its utilisation, the Minister of Fuel and Power, Mr Z. A. Bhutto, has confirmed. The Commission will also be entrusted with the task of governing electricity tariffs. Fixing of the power rates has so far been exclusively entrusted to the Water and Power Development Authorities in East and West Pakistan.

INDIA

Plant Manufacture

Chairman of Heavy Electricals Ltd., Mr K. B. Mathur, has been in Britain this month inspecting the training of Indian technicians for the Bhopal plant. He is proceeding to Prague and Moscow, joined by Mr M. Hayath, chairman of the Central Water and Power Commission, and Dr D. B. Karlekar, senior industrial adviser to the Government of India. There, they will finalise arrangements for the setting up of two other heavy electrical projects under the Third Plan, in which Czechoslovakia and Russia have offered assistance. Both the projects are expected to go into production in three years' time. While the Indo-Soviet project will produce 0.75 million kW hydro and thermal generating units and high-power motors for the steel works, the projects with Czechoslovak collaboration will manufacture thermal units of 0.6 million kW capacity in addition to high-pressure boilers and associated equipment. The delegation is expected back in Delhi late next month.

Bhakra Generator Trial

A trial run on the first 90 MW generator at the Bhakra hydro-electric station was successfully completed on 16 Sept. Four further units are to be installed in the six-storeyed power house, the second unit in February, 1961.

600 MW Thermal Power Station

Plans for augmenting power supplies in the Durgapur and Calcutta regions were recently announced by the West Bengal Government. First phase of the scheme provides for building a 600 MW thermal power station, claimed to be the biggest in Asia, at Bandel. The unit will initially have 300 MW installed capacity at a cost of Rs 30 crores. Finance for this phase is expected to be obtained from the US development loan fund. In the second phase the station will be extended to 600 MW rating. It is anticipated that the scheme will be completed by the end of 1963.

Plans are also in hand to enlarge the existing Durgapur station. The capacity of the station is to be raised from 60 MW to 210 MW and foreign exchange to finance the scheme has already been secured by a loan of Rs 9.5 crores from the US development loan fund. The rupee part of the capital outlay, estimated at Rs 4.5 crores, will be advanced by the West Bengal Government. Consulting engineers for the Durgapur thermal enlargement scheme are the Kulijian Corporation of USA and an American and West German firm will complete the plant by the middle of 1963.

CANADA

Bridge River Completed

The British Columbia Electric Co. has now completed development of the full h.e. potential of the Bridge River, totalling 681,500 h.p. Two 230 kV transmission lines convey the output to Vancouver and southern Vancouver Island, and a third line, scheduled to operate at 360 kV ultimately, will be completed to Cheekye substation next year.

Grid Links Power Companies

Economies in capital plant and facilities for power interchange are features of the grid linking three Canadian undertakings in the Maritime provinces, brought into operation on 22 Sept. The grid links the Nova Scotia Light and Power Co. with the systems of the Nova Scotia and New Brunswick electric power commissions. The grid will make

available a total spare capacity of 150 MW and will represent a saving of almost \$20 million in capital costs to one of the participating utilities and possibly higher sums for the other utilities. The inter-provincial power grid was brought into operation at Onslow substation near Truro. Total cost of the new power pool is estimated at \$4 million. Although a reserve of power will still be necessary, it will be reduced by about 20% and, largely because of the grid, completion of the Lequille and Alpena hydro developments is able to be postponed for at least a year. Operation will be controlled from Halifax, Fredericton and Trenton over a carrier current system.

MALAYA

Switchgear for Hydro Scheme

A switchgear contract valued at over £600,000 has been placed with AEI Switchgear Division, Willesden, by the Central Electricity Board of the Federation of Malaya. The switchgear order includes oil circuit-breakers for the first 132 kV substations in Malaya, which are to be sited at Jor power station and Rawang. It also includes 66 kV switchgear for a substation at Connaught Bridge. These three substations form part of the Cameron Highlands hydro-electric scheme and the consultants are Preece, Cardew and Rider.

AUSTRALIA

Vales Point Progress

Construction work on the New South Wales Vales Point thermal station is now well advanced. The station is 80 miles north of Sydney and is sited above vast coal deposits. The first 200 MW set is expected to come into operation in 1963 and the station will be completed by 1970.

Civil Hydro Contract

Approval of a £2 million contract for civil engineering work at the Barron River hydro-electric extension was announced recently. The contract covers diverting the Barron waters from below the falls through a horizontal inclined tunnel to an underground power station 940 ft below the falls. Transfield Qld. Pty will undertake the work. The Barron station will have two 30 MW water turbines and is scheduled for commissioning in 1963.



Sir Hamish D. MacLaren

THIS week brings the opening of the 1960-61 session of the Institution of Electrical Engineers and, conforming with our usual practice, we set out below some background notes on the president and the chairmen of the various London sections and local centres. First the president, **Sir Hamish D. MacLaren**, K.B.E., C.B., D.F.C., B.Sc.(ENG.), LL.D., M.I.E.E., will retire on 31 Oct. from the position of director of the Electrical Engineering Division of the Ship Department, Admiralty, which he has held since April, 1945. During his long and distinguished career with the Admiralty, Sir Hamish pioneered the introduction of a.c. supply and distribution in ships of the Royal Navy. He entered the Admiralty service in 1926 and, after a period with Royal dockyards at home and abroad, he was appointed to the Admiralty where he was responsible for drawing up the plans and specifications for the electrical installation in the naval base at Singapore, to which he was subsequently appointed as superintending electrical engineer. He returned to the Admiralty in 1940 as assistant director in charge of the Production branch of the Electrical Engineering Department and, on 1 April, 1945, he succeeded the late Sir James S. Pringle as director. Dealing next with the London sections, the chairman of the Electronics and

Communications Section is **Mr T. B. D. Terroni**, B.Sc., A.C.G.I., D.I.C., M.I.E.E., manager and chief engineer of the Transmission Division of the Automatic Telephone and Electric Co. Ltd. Many members will recall his Faraday lecture on "Communications Through the Ages," which he delivered in 1954-55. Mr Terroni was with Ferranti Ltd. and the International Telephone and Telegraph Laboratories for three years before joining the ATE Co. in 1931, with whom he became assistant chief engineer in 1946 and manager and chief engineer in 1953. He was chairman of the IEE Mersey and North Wales Centre in 1948-49.

The Measurement and Control Section has as its chairman **Mr C. G. Garton**, F.INST.P., M.I.E.E., who has served on that Committee for some time. He has been head of the Materials Department of the Electrical Research

engineer at the English Electric Stafford Works. Before taking position in 1953 he was engineer in the company's Research Laboratories at Stafford he was responsible for the department concerned with the development of power electrical apparatus.

Turning to the local centres alphabetical order is **Mr R. B. M.I.MECH.E., M.I.E.E.**, chairman of the Scottish Centre, who has been of the Dundee area of the Scotland Hydro-Electric Board since 1956. Earlier he was manager of the Board's northern area. He is the Royal College of Science and Technology, Glasgow, and, after a period with the Scottish Central Electric Power Co. in 1933 as technical assistant meter superintendent. After five years at that post he was promoted to

I.E.E. PRESIDENT, SECTION

Association since 1946, having originally joined that dept. in 1937. Before joining ERA in 1937 he was with the All-Union Electrotechnical Institute, Moscow, for four years. He served an apprenticeship with BTH at Rugby and from 1921 to 1924 was in the Test and Development Departments, followed by nine years in the firm's research laboratories.

Chairman of the Supply Section, **Mr J. E. L. Robinson**, M.Sc., M.I.E.E., has been an executive director of Associated Engineering Ltd. since July, 1958, but prior to that he was manager of the Transformer Department of Ferranti Ltd. for nine years, following three years as departmental manager there. Born in Belfast he was educated at Queen's University and received his early training with Ferranti's, where he became a research engineer in the Transformer Dept. in 1931. During the war he served as a major in the RA and from 1942 was with the Directorates of Artillery and Signals and Radar Development, in which he rose to lieutenant-colonel.

Another representative of the manufacturing industry is chairman of the Utilisation Section, **Mr J. M. Ferguson**, B.Sc.(ENG.), M.I.E.E., M.I.MECH.E., chief

tion engineer and in 1947 became area engineer (transmission and distribution). From 1948 to 1951 distribution engineer and deputy of the North of Scotland H.E.B. South Caledonia area.

The North Midland Centre is **Mr F. W. Fletcher**, M.I.E.E., assistant chief engineer in charge of Distribution Design (Substation Design) of the Yorkshire Electricity Board at head office, since 1950. He has, in fact, served around Leeds throughout his career, gaining early training with the Yorkshire Switchgear and Engineering Co. and technical education at the College of Technology, Leeds. He joined the Corporation of Leeds Department in 1925, ultimately becoming deputy to the substation and on nationalisation of the Leeds he joined the YEB chief engineer.

Representing the telephone section is **Lt-Col W. E. Gill**, T.D., M.I.E.E., telephone manager of the Peterborough area of the GPO, is chairman of the East Midland Centre. Educated at Nottingham he began his professional career in the Post Office Engineering Dept. in 1920. His service



Mr T. B. D. Terroni



Mr C. G. Garton



Mr J. E. L. Robinson



Mr J. M. Ferguson



Mr F. W. Fletcher

Department took him from inspector, Technical Section, N. Midland District, Nottingham, in 1930, to chief inspector in Coventry by 1936, and to assistant engineer, Glasgow telephone area, in 1938, being mobilised for war service in 1939. Returning to his civilian career, he was appointed area engineer at Chester in 1946, being responsible throughout Chester and N. Wales for planning and execution of works, a post which he held until transferring to his present position in Peterborough in 1952.

Another telephone engineer is chairman of the Southern Centre, **Mr R. Goford**, M.I.E.E., who is area engineer of the Portsmouth telephone area. Apart from a period during the war he, too, has served in the GPO throughout his career, which he started at Watford telephone exchange. He became a probationary inspector in 1934, serving in the N. Wales district and later in the



Lt-Col W. E. Gill



Mr R. Goford



Mr J. McA. Irons

F. Jones, C.B.E., E.R.D., M.Sc., M.I.E.E., who has been telephone manager at Birmingham for the past 11 years. He, too, has continuously served with the GPO since joining the Engineering Dept. in 1922, except for war service. Prior to the war he was engaged entirely on engineering work, first on radio and later on general communications. After the war he took up duties as telephone manager at York.

Chairman of the North Western Centre, **Mr F. Linley**, A.M.C.T., M.I.E.E., is a member of the North Western Electricity Board in addition to being manager of the Board's No. 1 sub-area. The latter position he has held since February, 1954, and, prior to that, he was purchasing officer to the Board for some months. He entered the industry with Manchester Corporation undertaking, after experience with the Armstrong Whitworth and Crossley Motor companies. At Manchester he held various positions before being appointed chief assistant mains engineer in 1944. At nationalisation he became sub-area mains engineer for the N. Western Board's No. 1 sub-area.

The chairman of the Mersey and North Wales Section, **Mr D. A. Picken**, M.I.E.E., M.A.M.I.E.E., M.INST.F., as HM Electrical Inspector of Factories, has been directly involved in the lengthy inquest proceedings arising from the disastrous Liverpool store fire, which were concluded last week (see page 536). He joined the Factory Inspectorate in 1945, after being electrical manager of the ICI, Billingham Division, during the difficult war years. He gained early training with the Walsall Corporation

Electricity Dept. and after a period as consumers' engineer at Workington was technical and commercial assistant with the Morecambe and Heysham Electric Supply Dept. until 1939.

Mr A. C. Thirtle, A.M.I.C.E., A.M.I.E.E., M.INST.F., chairman of the Western Centre, has been director of the Southern, South Western and South Wales Region of the CEBG since its formation in January, 1958, following seven years as Controller of the South Western Division. He spent the early part of his career with the Norwich Corporation Electricity Dept., one of the most active municipal undertakings in the country, and ultimately held the position of generation engineer. There followed four years at Swansea as deputy city electrical engineer and manager, and in 1944 he went to Carlisle as city electrical engineer and manager. From 1948 to 1950 he was chief generation engineer (operation), Eastern Division.

Representing the technical education side, **Mr D. H. Thomas**, M.Sc.TECH., B.Sc.(ENG.), M.I.E.E., who is chairman of the North Eastern Centre, has been Head of the Department of Electrical Engineering at Rutherford College of Technology since 1947. In that period the Department has trebled its size and Mr Thomas has been largely responsible for the specification and layout of the new laboratories. He started with Metropolitan-Vickers and was on their research staff before going for a further year of post-graduate study and research under Prof Barkhausen, at Dresden. Returning to Britain he became lecturer in telecommunications at University College, Nottingham, in 1938.

CENTRE CHAIRMEN

N.W. area of the London Telephone Region. Subsequently, he became a probationary assistant engineer at Colchester and in the External Plant and Protection Branch of the engineer-in-chief's office of the Post Office. In 1941 he was seconded to the MoS Directorate of Hand Tools at Wolverhampton and, following a period as chief technical assistant in charge of the Directorate's Sheffield office, was in the Directorate of General Stores in London towards the end of the war, before returning to the Post Office, being at Brighton in 1949 and area engineer, Portsmouth, in 1950.

The Northern Ireland Centre has a supply engineer as chairman, **Mr J. McA. Irons**, M.I.E.E., who has served with the Electricity Board for Northern Ireland since 1932, latterly as technical assistant (sales and development) at headquarters. He previously held positions of assistant district engineer, area manager at Dungannon, Lurgan and at Ballymena. An old Faraday Hse student, he received practical training with Crossley Brothers Ltd. and Londonderry Corporation Electricity Dept.

A third telephone engineer is chairman of the South Midland Centre, **Brig**



Brig F. Jones



Mr F. Linley



Mr D. A. Picken



Mr A. C. Thirtle



Mr D. H. Thomas

Personalities *in the industry*



Mr D. St. C. Barrie



Mr T. W. Wilcox



Mr F. S. Barton



Dr S. English



Mr J. E. Flower

Mr J. O. Knowles, M.A., M.I.E.E., M.A.M.I.E.E., a director of Metal Industries Ltd., is leader of a nine-man team of British industrialists who last week-end flew to Western Australia where they are to explore the opportunities to establish new industrial capacity. Their visit is scheduled to last ten days.

District commercial engineer at Warrington, Merseyside and North Wales Electricity Board for the past 11 years, **Mr D. St. C. Barrie**, A.M.I.E.E., A.M.B.I.M., has been appointed senior assistant to the commercial officer of the Board's No. 2 sub-area, as from 1 Oct. (*ESH, page 138). Educated at Portsmouth Grammar School and Southampton University College, Mr Barrie served with the Portsmouth Corporation Electricity Dept. from 1931 to 1938 when he joined the Fareham undertaking as meter engineer. After war service he joined the St. Helens Corporation as assistant consumers' engineer and, after vesting day, became sales and service superintendent for the Runcorn district of MANWEB.

Mr Alan Plumptre, district commercial engineer at Stockton on Tees to the North Eastern Electricity Board, has left England on a two-month exchange visit to the Detroit Light and Power Co., USA.

Merz and McLellan announce that they have taken into partnership, with effect from 1 Oct., **Mr T. W. Wilcox**, M.I.E.E., who has been a member of their staff since 1947. He will normally be at their Newcastle office, where he has been chief electrical engineer for the past eight years. Mr Wilcox, who was chairman of the IEE North Eastern Centre in 1957-58, has been an active member of a number of BSI Committees on switchgear and allied subjects. He commenced his engineering career with the BTH Co. at Willesden in 1930, and five years later became the first special switchgear trainee to have short circuit testing experience at the Switchgear Testing Co. Ltd., Trafford Pk. Returning to Willesden

in 1936 he was appointed a switchgear design engineer and, in addition, was put in charge of several special switchgear investigations. The following year he became section leader in charge of all experimental and testing work on oil, air and air blast circuit-breakers, and for some years personally conducted all BTH testing at the Switchgear Testing Co., Manchester. At the end of the war he was section leader in charge of the design of all h.v. oil and air-blast c.b.s and was responsible for the c.b.s and ancillary plant in the 132 kV substation at Andover—the first of its kind in Britain.

Mr F. S. Barton, C.B.E., M.A., B.Sc., M.I.E.E., has joined the board of Painton and Co. Ltd., Northampton. Until recently Mr Barton was the Counsellor on Defence Research and Supply in the United Kingdom High Commission in Ottawa. Prior to that he held a number of senior positions in the Ministry of Supply, including that of Director-General of Electronic Research and Development, while from 1941 to 1946 he was Director of Radio Engineering for the British Air Commission in the USA.

Honorary membership of the Illuminating Engineering Society has been conferred upon **Dr S. English**, D.Sc., M.I.E.E., F.I.E.S., F.INST.P., chairman of Holophane Ltd., "in recognition of his valuable services to the Society and of his contributions to the science of lighting, particularly in the use of glass for the control of light, and in appreciation of his leadership in the national and international administration of lighting." Dr English was president of the IES in 1937-38 and led the British delegation at several meetings of the International Commission on Illumination. He joined Holophane Ltd. in 1927 as head of their research department; was appointed technical director in 1936, was deputy managing director from 1946 to 1949, joint managing director till 1955, vice-chairman 1955-57, and became chairman in 1957. He is a past-president of the Society of Glass Technology and a past-chair-

man of the National Illumination Committee.

Manager of the South Western Electricity Board's former South Cornwall district since 1948, **Mr J. E. Flower**, M.I.E.E., retired at the end of Sept. (*ESH, page 102.) Mr Flower was educated at Pembroke School, Lytham, Lancs, and later at the Manchester College of Technology. After early training as a pupil apprentice in mechanical engineering, Mr Flower joined the Lancashire Electric Power Co. in 1927; four years later he was appointed district engineer to the East Anglian Electric Supply Co. In 1937 he became resident engineer and manager of the Newmarket Electric Light Co. and he held this post until 1946 when he joined the St. Austell and District Electric Light and Power Co. in Cornwall as their chief engineer and manager.

Mr J. F. Mallabar, F.C.A., has joined the board and has been appointed chairman of Phoenix Telephone and Electric Holdings in place of **Mr G. F. Shipman**, who has become deputy chairman. Mr Mallabar is also a director of the Plessey Co. Ltd., one of the consortium of several firms which was recently formed under the title of Combined Telephone Holdings Ltd. to acquire the Phoenix business.

The Minister of Power has reappointed the **Rt Hon Lord Citrine**, G.B.E., LL.D., COMP.I.E.E., as a part-time member of the Electricity Council.

The Plessey Co. Ltd. announce the resignation of **Mr E. J. Earnshaw** from the board of the parent company and also from the boards of the other companies within the group, of which he is a member.

Formerly station superintendent at Agecroft "A" power station, North West, Merseyside and North Wales Division, CEGB, **Mr A. H. Carroll**, A.M.INST.F., A.A.M.I.E.E., has retired after 47 years in the industry.

* Denotes revision to the "Electricity Supply Handbook, 1960."

Mr K. Chapman

tative for the northern section of London and the Home Counties. Mr Dent was previously with the Power Centre Co. and British Central Electrical Co.

Mr A. K. Craighead, secretary of Allied Ironfounders Ltd.; **Mr T. I. Hobart**, chairman and managing director, Bilston Foundries; **Mr T. L. Reed**, sales sales controller, Allied Ironfounders group; and **Mr G. E. Richards**, managing director, Leisure Kitchen Equipment, have been appointed directors of Allied Ironfounders.

Mr R. Lewis, who, since the nationalisation of the industry, has been Lincolnshire sub-area secretary of the East Midlands Electricity Board, retired on 30 Sept. after 46 years in the industry. (*ESH, page 114.) He began his career in 1914 on the staff of Lincoln Corporation electricity undertaking. A number of retirement gifts have been made to him by his colleagues.

Mr P. A. M. Curry, M.A., B.Sc., M.B.A. (Harvard) has been appointed deputy to Mr H. St. A. Malleon, Head of the Government and Industrial Valve Division of Mullard Ltd.

London Transport Executive announces that **Mr S. G. Jones**, legal adviser, has been appointed secretary to the Executive with effect from 3 Oct. He succeeds Mr R. M. Robbins whose appointment as chief commercial and public relations officer we recently reported.

OBITUARY

Mr P. W. Tucker, M.I.E.E., formerly technical editor of *The Electrical Review*, died on 2 Oct., aged 65. He had served with our contemporary since 1925, initially as technical sub-editor.

Mr W. J. Chalk, B.A., who was in charge of the Frequency Allocations Section of the BBC Engineering Information Department, died on 24 Sept. aged 61.

Prof Bernard Hague, Ph.D., D.Sc., F.C.G.I., D.I.C., M.I.E.E., M.A.M.I.E.E., who had held the James Watt Chair of Electrical Engineering at Glasgow University since 1946, died on 29 Sept. aged 67. He became a lecturer at the City and Guilds in 1920, following experience with Ferranti Ltd. and the RAE. He then held a lecturing appointment at Glasgow University before going to the Brooklyn Polytechnic Institute, New York, for a year, and returned to Glasgow in 1930 to be senior lecturer in the department of Electrical Engineering until his appointment as professor in 1946. Dr Hague was the author of several textbooks and numerous contributions to technical journals.

Lord Simon of Wythenshawe, president of Simon-Carves Ltd. and Henry Simon (Holdings) Ltd., died on 3 Oct., aged 80. During the last war he was a member of the Advisory Council for Fuel and Power, and from 1947 to 1952 served as chairman of the BBC. An authority on municipal and housing affairs—he served on Manchester City Council for many years—he was active in educational and other public affairs.

NEW LITERATURE

Electronic computers and their business applications

by A. J. Burton and R. G. Mills

ONE of the difficulties in introducing computer techniques into everyday business applications is, of course, capital cost. The other is to overcome the inherent distrust of the average business mind in a device, the working of which appears beyond his comprehension. Part of this psychological barrier may be due to the use of the word "computer" instead of "calculator," for the words are synonymous. Why should we have an "electronic computer" and a mechanical "calculator"? It may be argued that the mechanical calculating machine, so widely accepted in business today, is also a device the working of which is incomprehensible to the average user but he can, and does, trust the results he gets from it once he has learned to use it.

There are, of course, new problems in applying "computer" techniques to a particular business use, but they are quite easily solvable and the methods comparatively easy to acquire. In this volume the authors have attempted to make the application of computer techniques to business comprehensible to the average business man. Taking an imaginary design of computer, "CASEAC," he first explains how it can be "tailored" to suit a particular application and the first steps in programming and staff instruction.

In the third part of the volume he deals with typical business applications which should be comprehensible once the early matter has been digested. At the end, the business man may still be hazy about how a computer works but he will appreciate how to apply it to his own problems and will be in a position to discuss them with computer experts intelligently. A useful book indeed. Published by Ernest Benn. Price 45s. 314 pages, 8½ in. by 5 in. 51 diagrams and 18 plates.

Working aluminium in shipyards

THIS is the second edition of the Aluminium Development Association's information bulletin 18, first published in 1951. Nine years between the two editions has seen a great advance in the use of aluminium in shipbuilding with corresponding progress in developments and applications. Although the title refers to aluminium alone, it is intended to cover alloys based on aluminium as well. Precautions to be taken in storing, identifying and handling are outlined as well as recommendations for working practices. A chapter on the behaviour of aluminium in contact with other metals is of vital significance and among the five appendixes is a schedule of alloys which are considered suitable for shipbuilding. Published by the Aluminium Development Association, second edition. Price 2s. 60 pages, 8½ in. by 5½ in. Paperboard covers.

Laplace Transforms for radio and electronic engineers

by W. D. Day, GRAD. I.E.E., A.M.BRIT.I.R.E.

WHEN Laplace originally began his investigations on an infinite integral nearly 150 years ago he could have had little idea that here, in the mid-twentieth century, his work would be of such interest and value to electrical and radio engineers as to justify the publication of a number of books on the subject. Some credit must, however, go to Heaviside who, a century after Laplace, revived interest with his operational calculus, but, whatever the reason, the Laplace Transform is now of such importance that it is beginning to feature widely in Higher National Certificate syllabuses. The author has here endeavoured to show, in language with which the average engineering student is familiar, what is meant by a Laplace Transform and how it can profitably be applied to electrical problems. Let us admit that it is not light reading by any show of imagination. It needs careful and concentrated study but the result will be rewarding. The author knows his subject and has had the co-operation of his students in that they have acted as "guinea pigs" for his first drafts. Published by Iliffe and Sons. Price 32s 6d. 179 pages, 8½ in. by 5½ in.

Progress in plastics 1959

edited by Philip Morgan, M.A.

THIS is a record of papers read before the International Plastics Convention at Olympia in 1959. It contains some useful up-to-date information on the newer plastics materials, notably polypropylene and the latest epoxides. Progress in glass fibre reinforced plastics both at home and abroad is also summarised in papers by Tunteler, Kraft, Parkyn and Blankmeyer and there is an interesting description of foamed smokes and their uses by Betty Lou Raskin. Final papers cover extrusion studies on thermoplastics. Published by Iliffe and Sons. Price 55s. 216 pages, 9½ in. by 6 in., with diagrams and plates.

BOOKS RECEIVED

Applied Boolean Algebra, by F. E. Hohn. Text-book for both mathematicians and engineers pitched on sixth-form mathematical level. Published by Macmillan and Co., New York, 139 pages, 9½ in. by 5½ in. Price 17s 6d.

Magnetism and Electromagnetism, by A. Schure. An elementary study. Published by Chapman and Hall, 168 pages, 8½ in. by 5½ in. Price 37s 6d.

Experimental Plastics, by C. A. Redfarn and J. Bedford. Text-book for practical work for Plastics Institute examination. Published by Iliffe and Sons Ltd., 140 pages, 8½ in. by 5½ in. Price 22s 6d.

Low Frequency Amplifiers, by A. Schure. Outline for amplifiers for up to 100 kc/s. Published by Chapman and Hall, 150 pages, 8½ in. by 5½ in. Price 32s.

Relativity for Engineers and Science Teachers, by L. H. A. Carr. Presents special theory and relativity in form suitable for average engineer or engineering student. Published by Macdonald and Co., 52 pages, 7½ in. by 4½ in. Price 12s 6d.

From m.c.b. to 800 A

PRODUCTION STARTS AT E.C.C.'s NEW FACTORY

WINGING into production is the new E.C.C. (Moulded Breakers) Ltd., works at Wolverhampton, which was officially opened last week. Four ranges of breakers are made with current ratings extending from 5 A to 800 A. One characteristic of these breakers is the use of phenolic moulded cases and they are designed for use either singly or assembled into multiple panels for building into boards of any layout to suit users' requirements. For the start-up of this factory component parts were temporarily imported from the parent company, Federal Pacific Electric Co. of New York. This has allowed production to be achieved while the new factory is in process. At the present time the steel and sub-assemblies are made in the factory, which is a modern design with ample room for expansion in the future.

The smallest range made is the "Stab-lok" miniature circuit-breaker, available in ranges from 5 A to 60 A. The design originated in the USA and over 75 million of these breakers have been sold. The name originates from the special contact which enables a circuit-breaker to be plugged into the busbar. Units are arranged on one side of the busbar thus providing a compact, flexible arrangement, ideal for distribution boards. The circuit-breaker is factory sealed and the thermal overload and magnetic trips are factory set and tested. Each tripping mechanism is separately calibrated and subsequently tested within fixed limits at twice full rating. Subsequently the testing provides a general check on all manufacturing tolerances.

For the three ranges of higher ratings there is a common feature in the rotary handle which rotates through 45° or 90°. This has the advantage of providing an intermediate position which clearly shows when the breaker has opened. A simple cam arrangement is also in the handle

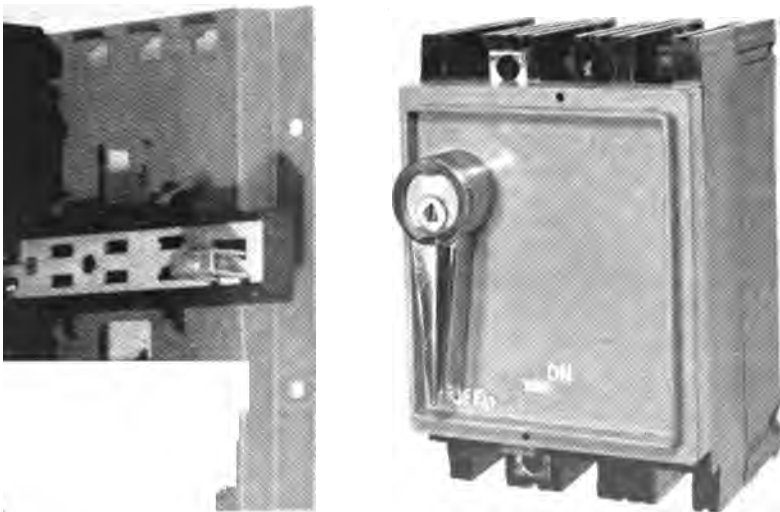
which can be arranged to operate interlocks on the cover of an enclosure. In addition a rim round the base of the handle can be raised and with the use of a padlock the switch can be locked in either the open or closed position.

The smallest of these three types of circuit-breakers has a range of 15 A to 100 A at 400 V a.c. or 125 V to 200 V d.c. This, like the "Stab-lok," is a factory sealed unit in which the trip settings are calibrated in a temperature controlled room. The single pole units can be readily built up into double or triple pole circuit-breakers and these breakers built into control panels as may be required. For the connection of the busbar of these units, both a clamp terminal, which the makers recommend, and a connection for a sweated lug are provided. It is stated that the single-pole units of this circuit-breaker have passed short-circuit tests at 9,000 A at 250 V a.c.

For heavier duty, a range is offered with capacities from 70 A to 400 A at 600 V a.c. designed with the usual contacts of silver alloy and corrosion resistant bearings. A heavier range provides for capacities from 125 A to 800 A at 600 V and is the largest rating produced in this factory. It follows the same basic principles of the smaller breakers, but in this case an interchangeable tripping unit is provided which can, if desired, be replaced on site by one of a different current rating. In addition the magnetic trip is adjustable in this and in the 400 A breaker but in all of the four ranges the thermal overload trip is factory calibrated and sealed and is not adjustable on site. Tripping characteristic curves are supplied.

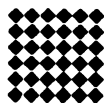
All these units can be combined in any arrangement required. The smaller units are mounted on a sub-frame suitable for mounting within a suitable panel. Advantage has been taken of the flexibility of rating of the "Stab-lok" miniature breaker to produce a range of consumer control units of competitive price. These are available with from four to twelve ways with breakers of any desired rating combination. In addition a consumer's unit arranged for a separate off-peak circuit is supplied.

These new ranges of circuit-breakers have proved their flexibility in meeting users' requirements under differing types of industry. It is planned to build all types for stocks so that a 24 hours' service will be available at all the company's distributing centres. These circuit-breakers have already proved their design in service and are an important addition to an essentially competitive section of the industry.



Left. Small breaker showing "Stab-lok" principle of busbar connection

Right. Rotary type handle used for breakers up to 800 amp, with centre trip position



Russia's supply programme

CANADIAN ENGINEERS IMPRESSED BY ORGANISATION

CANADIAN power supply engineers who visited the USSR in May found that Russian engineering and construction of power installations, apart from the relatively unimportant factor of finish, was "outstanding" in the field of e.h.v. transmission and hydro generation. Manufacturing of power equipment generally was good, but achievements in the field of thermal and nuclear power generation were not particularly impressive.

These opinions are set out in a report on the visit, prepared by two engineers of the Hydro-Electric Power Commission of Ontario who took part. The report includes a valuable translation of a lecture on the main aspects of electric power development in the USSR, delivered to the visiting delegation by a Mr N. Bondarev, who is described as chairman of Planning and Production at the Ministry of Power Station Construction.

Planning

Development of the Russian power system seems to be guided by two plans. One is a 20-year general plan, the other a more specific seven-year plan; the current one covers a period ending in 1965. Planning policy seems based on securing maximum capacity increase in given time, with other factors, such as attaining lowest overall cost of energy, considered of secondary importance. This policy is behind the preference being given to thermal stations at present, despite the large unharnessed hydro potential of the country.

The target for 1965 is 113,000 MW installed capacity, 90,400 MW thermal and 22,600 MW hydro. This involves commissioning an extra 43,880 MW of thermal plant and 9,800 MW of hydro plant, compared with the end of 1959. By the end of 1965, hydro should be providing 20% of the annual generation of 500×10^9 kWh.

Large-capacity power stations are the basis of policy at present. Capacities are up to 6,000 MW hydro and 2,400 MW thermal, and individual generating units are sized accordingly, up to 500 MW hydro and 300 MW single-shaft thermal units and possibly 800 MW two-shaft. Accompanying this generating plan is a corresponding scheme for extending transmission, with 6,600 miles of 500 kV line featuring in the seven-year programme, together with 4,000 miles at 300 kV and 19,000 at 220 kV.

On the transmission side, two networks are involved. One is the European grid, based on three 400 kV circuits inter-connecting the Volga, Moscow and the Urals. The other network is an Asian grid, still to be built, a 500 kV scheme in the Bratsk-Irkutsk area, north of Mongolia. There are long-term plans for extension of both networks, and for their eventual interconnection by long-distance d.c. transmission lines.

In considering Russian engineering designs, their economic basis has to be kept in mind. Although depreciation is charged, there is no interest charged on the capital required; schemes are financed out of state revenues. On this basis, thermal power at h.v. busbars cost about four times as much as hydro power.

Maximum capacity of post-war plants at present operating is 600 MW, using mostly 100 MW sets, though with some recent additions at 150 MW. Production in fact was designed to produce sets and boilers of these ratings at what the report calls moderate steam conditions. Recently, with a new accent placed on fossil-fuelled stations, there has been increased activity in design of thermal plant, and 300 MW machines are in production.

In addition to the sets being built, designs are in hand for 500, 600 and 800 MW units. Steam conditions are being advanced rapidly. More detailed discussion of sets is given later in this article.

Much use of precast concrete and prestressed concrete was noticed at power stations, with very little structural steel in use. Even turbine blocks for large sets are built from precast concrete. The report observes that the general design, housekeeping and construction at stations seen operating was not impressive, but that Russian engineers indicated that many improvements would be evident in new stations.

Hydro Stations

Russian hydro development is made more difficult by relatively unfavourable geographical conditions. Substantial settlement of structures is designed for, apparently with little ill effects. Constructional methods are based on maximum use of mechanisation and seemed very efficient to the Canadian delegation. At a site with an average temperature of -11°F , concrete was poured for nine months of the year. However, a low standard of construction was found in many places.

115 MW Kaplan units are in operation, and 225 Francis types are being built. 500 MW sets are at design stage. Kaplan units are used exclusively for head installations. No fixed-blade propeller units produced in Russia. Transport is seen as the main factor limiting units size; Russian engineers say they see no reason why 1,000 MW units cannot be produced in "not too distant future."

Excitation of large units is supplied by mercury rectifiers. The argument is that these provide fast reliable operation and give good performance from a stability aspect when long transmission lines are being built. Cost of rectifiers is reckoned to be less than for rotary exciters of comparable performance.

Nuclear Stations

Nuclear power stations play only a minor part in the current USSR seven-year plan. The general view is that nuclear energy will not compete economically for a long time, that safety and reliability characteristics are not yet known. Nor do the Russians consider that they have a good, reliable fuel. Only when one is available will construction be accelerated. The present nuclear effort in the power field is directed to obtaining experience with a range of types of nuclear station.

neral impression of the Canadians is that Russia a realistic, down-to-earth view of nuclear power, ng conditions in the USSR, and that the engineer- anything, conservative.

ission

vative is not suggested as an epithet for the work nsmission field. Currently, this is moving into use .V. There is one d.c. line operating, a 30 MW ine 70 miles long, used for experimental work. A long 750 MW, 800 kV line from Stalingrad to the in is scheduled for operation in 1961-62, but in the publicity this has received, it is particularly g to note the Canadian statement that this will nsidered to have high reliability and is supported nes. It is clearly intended to give experience of mission technology.

gh 500 kV will remain the highest voltage used in ion for some time, the 20-year plan envisages .a.c. and d.c.

7 construction seen at Stalingrad involved three- r bundles using 480 sq mm ACSR conductors. The acing is 40 cm, with between 11 and 12 metres phases. Two 21-unit strain insulators are used per d the towers are of steel construction.

'A air blast circuit-breakers are rated at 15,000 ng six interrupters and with air at 290 lb/sq in.

the transmission design developments is a series oricated, prestressed spun concrete guyed towers e lines up to 500 kV. Total weight of steel per kept down to 2.1 tons, including guys. A feature release clamps for conductors when longitudinal eds 2½ tons per phase.

of systems for transient stability is based on e to ground faults of not more than 0.1 seconds The Russians claim that constant voltage behind reactance can be maintained with their standard egulating equipment, while with electronic high ulation, low-reactance generators are not required.

1 Details

of Russian work in thermal power station design apparent in the brief reports of visits to specific tions. For example, the Cherepetsk station, about ; south east of Moscow, has four 150 MW sets.

The boilers are fired with brown coal of 3,960 B.Th.U./lb calorific value, 40% ash. Steam conditions at t.s.v. are 1,022°F, 2,750 lb/sq in. with reheat to 968°F for the first two units, about 50° higher in temperature for the second two. There are two natural circulation boilers for each set. Sets have single flow h.p. and i.p. cylinders and double flow l.p. with Baumann exhausts. The generators are hydrogen cooled. More than one quarter of the station staff of 500 (excluding maintenance staff) are women. It is intended that two 300 MW sets working at 3,530 lb/sq in., 1,075°F will be commissioned by the end of 1967.

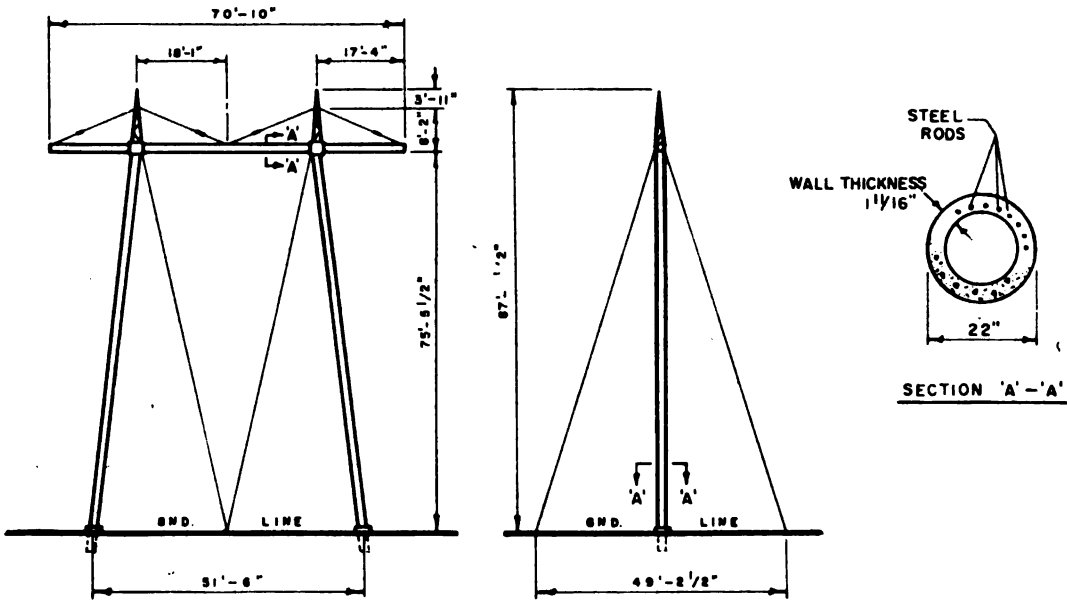
At the Staro-Beshevsk station near Stalino in the Don Basin, three 100 MW sets are in commission, and six 200 MW sets are planned for installation. Coal of 12,600 B.Th.U./lb, 20% ash is available. There are two boilers/set at present, with steam conditions 1,470 lb/sq in., 1,005°F with reheat to the same temperature. Steam conditions for the 200 MW sets will be 2,060 lb/sq in., 1,060°F, with reheat to the same temperature. There are 120 operators for the first three units; stations throughout the whole area are serviced by a large central maintenance staff.

Design details for the 300 MW sets were obtained at the Kharkov Turbine Works, which has a capacity of 2,000 MW/year in steam turbines and also makes hydro and gas turbines. Steam conditions for the 300 MW design are 3,525 lb/sq in., 1,077°F with reheat to 1,050°F. There is a single flow h.p. and i.p. cylinder and three-flow l.p. Last row blading is 39 in. long, and is designed for 8% moisture content steam (centrifugal force, 220 tons/blade). No austenitic steels are used in the design. The rotors are solid. Generators are water cooled.

Prototype development is in hand for steam conditions of 4,400 lb/sq in., 1,200°F. Designs for 500, 600 and 800 MW sets are in preparation, the first for 1962 delivery, the others for 1963. Short schedules are claimed; 22 months for design and production of the 300 MW unit. The works say there is intention to test a water-operated governor for use with steam turbines, to eliminate fire hazard associated with oil.

At the Leningrad Metal Works, a 300 MW 3,530 lb/sq in. 1,077°F set with 7,270 B.Th.U./lb heat rate is to be completed this year. A tandem 500 MW set is being designed, and a cross-compound 1,000 MW unit, but the intention is to wait for progress by boiler manufacturers before constructing such sets. Water-cooled stators have been built since 1957.

ie of concrete er possible to ise in steel is haracteristics y engineering e USSR. This for a 500 kV line, and uses d prestressed ete structures 'orm of guyed ers. There is cu yd and 6.7 crete in each , and 2.1 ton cluding guys. ckness of the n concrete is 2 in. Release e used for the rs, permitting slip when the gitudinal load nes excessive



equipment for industry

Distance measurement protection

IN TENDED for rapid discriminative clearance of faulty feeders on complex 11 kV and 33 kV networks, a new low cost phase fault protection system has been introduced. This is an alternative choice where an inverse-time overcurrent system is inadequate. Its operation depends on fault distance measurement by means of a single admittance (mho) relay in conjunction with instantaneous overcurrent relays. Three zones of distance measurement are permitted by the mho relay and by employing a timing unit the ranges are successively varied from zones 1 to 3. Operating time for zone 1 is approximately 0.1 sec. Known as the SSM3V system, the main equipment is housed in a case measuring 20 in. by 6 in. by 6 in. *The English Electric Co. Ltd., Marconi Hse, Strand, W.C.2.*

Contemporary-styled panel meters

FOUR models of a range of contemporary-styled panel meters are announced. These incorporate open scales to give shadowless readings, mirror or other special scales being available to order. Nominal scale lengths are from 1½ in. to 4½ in. Currents in the range 10 mA to 5 A a.c. or d.c. are catered for by rectifier or thermocouple meter types in this "Vista" range, having moving-coil centre pole movements. For

the range 10 mA to 50 A, moving-iron movements are employed. Voltmeters are available for 10 V upwards. Accuracy of measurement is said to be 1% f.s.d.

Also announced is a valve tester capable of handling a range of 5,000 valves covering British, American and continental types. It has 21 valve holders and facilities are provided for testing both earlier valve types and the latest TV and 12 V car radio valves. This instrument, 45C, measures mutual conductance up to 15 mA/V with sufficient accuracy, it is claimed, to permit of valve "matching." *Taylor Electrical Instruments Ltd., Montrose Ave, Slough, Bucks.*

Self-healing miniature capacitor

VACUUM coating poly-terephthalic acid dielectric with aluminium enables production of an exceedingly compact capacitor occupying only 50% of the space taken up by an equivalent paper tubular type. A valuable property of the dielectric used is its self-healing effect after puncture. This is the WIMA "Tropyfol" which is offered in 125 V and 400 V ratings. The capacitor is encapsulated in moisture-proof plastic resin and an operating temperature range of between -55°C and 100°C is claimed with a maximum of 125°C short time. Contacts are sprayed to the end faces of

the coiled element to give low inductance and good H.F. contact. With the continuous quest for miniaturisation, this capacitor has obvious applications in the electronic industry. *Waycom Ltd., Empire Bldgs, Duke St Hill, S.E.1.*

Plug-in time switch

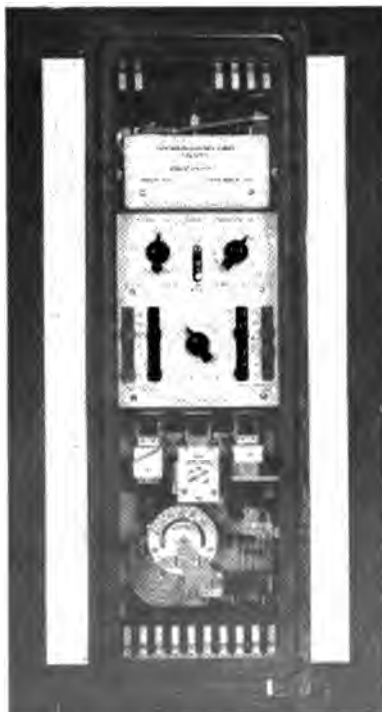
SU ITABLE for under-floor and block-storage electric heating the BP range of 30 A plug-in time switches can be set to give a wide range of switching cycles. A typical switch can be set to cater for a whole year if so required, switching loads in or out for specified days, week-ends or even longer periods. *Venner Ltd., Kingston By-pass, New Malden, Surrey.*

Improved lighting control unit

THE original series ALC.3 photo-cell lighting control unit produced by Lancashire Dynamo, has been redesigned to give improved performance at lower cost. The new unit, intended for switching any form of lighting in streets, factories, shops, etc., is narrowly sensitive to vertical north-light to avoid interference from artificial lights. It is weather-proofed by means of a neoprene seal and the window is of moulded glass to inhibit accumulation of dust or snow. *Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs.*

Portable searchlight unit

A PORTABLE searchlight unit has been devised to assist in rescue operations and other emergencies. Power is supplied to a handlamp from a lightweight silver/zinc accumulator in a carrying case. The combination is claimed to provide a good working light for one to two hours. The handlamp can be spiked into the ground or clipped to a convenient structure. *Venner Accumulators Ltd., Kingston By-pass, New Malden, Surrey.*



Wide range valve tester by Taylor Instruments, Model 45C, complete with c.r. tube test adaptor

English Electric distance protection equipment incorporating relays and timing unit

Venner plug-in time switch for controlling electrical storage heating loads and, below, portable searchlight unit comprising handlamp, lightweight accumulator and accessories



for the electrical trade

Simplifying the wash-dry cycle

SIMPLE control of the increasingly complicated wash-drying operation is a feature of the "Polymatic" tandem laundry machine. Recently introduced from West Germany, this combination machine is equipped with individual pumps and motors for the two tubs. Control, however, is made easy by the use of push-buttons and a rotary switch. These controls and a pilot light are arranged in an effective yet unconfusing group in a decorative triangular panel of pale blue on the front of the white stove enamel casing. The dial controls timing of the agitator action and the pumps, whilst three buttons cover heater, spin dryer and switching off. The spin dryer and its pump function together automatically.

Total rating of this combination is somewhere in excess of 2,300 kW, 2 kW of this representing the heater rating. "Polymatic" has all the finer points expected in the luxury class to which it belongs—sediment trap, accessories for handling clothes, hook-on draining pipes, working table-top and swivel castors. Capacity is 5 lb washer and 6 lb dryer. Price £86 18s 9d. *Polymatic Domestic Appliances, Cater Bldgs, 1 Cater St, Bradford.*

Swedish units fits any kitchen

A WIDE selection of domestic kitchen units is to be marketed here by the adventurous Swedish firm, Electroheliol. Included in the enterprise are built-in units, small-scale appliances for the flat or bedsitter, and a few luxury class items.

In the first category are three counter-top cookers designed for flush mounting alongside existing fittings. They employ "Quickplates," heating plates made of extra-thin material, claimed to have an exceptionally short heating-up time and good response to changes in switch settings. Two of these built-in units are double-plate models, at £15 10s and £14 10s; the other has three plates and is priced £20. Also designed for building-in are four refrigerators. Known as "King Cold," they range from a 1.8 cu ft model at £47 6s 3d tax paid to a 4.3 cu ft model at £74 10s 4d.

For use in the smallest living quarters are two handy cooking units, single- and double-plate table cookers, also incorporating "Quickplates." They have white vitreous enamel tops with blue plastics switches and handles and are priced £6 6s and £9 9s. A multi-purpose heating jug of three pint capacity is also in this

TRADE PUBLICATIONS

LINOLITE.—1960-61 catalogue and price list of light fittings, strip reflectors and signs. Linolite Ltd., 11 Baker St, W.1.

METWAY.—56-page catalogue MYP/4 with prices of replacement elements and spirals from Metway Electrical Industries, Metway Works, Canning St, Kemp Town, Brighton.

NU-SWIFT.—Folder on applications of portable fire extinguishers. Nu-Swift Ltd., Fire Protection Centre, 25 Piccadilly, W.1.

HELLERMANN.—30-page illustrated brochure of compression terminals and tools from Hellermann Ltd., Crawley, Sussex.

OSPREY.—Leaflet on a sodium tube lantern for Group A and A1 lighting from Siemens-Ediswan, A.E.I. Lamp and Lighting Dept., 38 Upper Thames St, E.C.4.

CRYSELCO.—38-page price list booklet in colour describing lamps and fittings by Cryselco Ltd., Kempston Wks, Bedford.

space-saving range, selling at £4 12s tax paid.

The one full-scale cooker in this selection is the £70 "Electroheliol Luxury Cooker," Model S. 21, again embodying four "Quickplates," in this case with an increased loading and fitted with "Heli-stat" safety cut-outs. There is no separate grill and no splash-plate. The oven, fitted with a glass door and interior light, provides for the installation of a rotary spit, costing £7 1s 11d extra. A large storage chamber and plate-warming compartment are included. Also in the luxury class are "Helifrost" home freezers, chest-type cabinets said to maintain a temperature of 0°F. They incorporate British-made "Tecumseh" compressor units and sell at well over £100. UK agents: *Helimatic, 22 Buckingham Palace Rd, S.W.1.*

Out-doing the gas poker

A BLAST of hot air from the new GEC domestic fire lighter ignites most solid fuels within a few minutes. There is no question about its superiority over the tried method of wood and paper; moreover, it is far cheaper to run and quicker than a gas lighter or poker. Obviously it will find its greatest market where a solid fuel fire is preferred and where provision for gas lighting is not already installed.

In appearance it is rather like a gun, with a rounded butt which contains a fan and motor unit. Air is forced down the "barrel" through a ceramic tube threaded with an 1,800 W element arranged to form 24 small coils, down the centre. The space between this

tube and the outer casing also receives a strong air flow, thus preventing heat loss as well as ensuring a cool surface. The air is ejected at a temperature of 800°C, but disperses quickly and a few inches beyond the outlet only a warm flow is felt. The gun is placed with its nozzle buried in the fuel and supported at the handle end by a stand of tubular steel. Coal blazes within a few minutes, smokeless fuels in as little as 6 min and coke nuts in about 13 min. Once the fuel is alight the element may be switched off, allowing the fan to act as a bellows.

GEC are well aware that the spacegun-like appearance of this appliance will attract children and have guarded against accidents by incorporating a locking switch. To activate the element a specially designed lever must be inserted into the switch mechanism on the top of the handle. When pushed over into the "on" position this lever cannot be removed. It has been pointed out that the fire lighter costs less to run than the price of matches and, taken over a year or so, this saving and the elimination of wood costs should offset the original outlay, which will not be much more than £5. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*

Spin dryer price drop

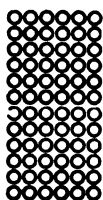
A NOTHER spin dryer to be reduced in price is the "Pirouette," which sells at £23 2s tax paid from 3 Oct. This represents a drop of £5 5s. *Parkinson Cowan Appliances, Stechford, Birmingham 33.*

Twice-as-bright flash bulbs

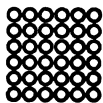
THE new "Tru-Flash" range of flash bulbs includes one which gives twice as much light, but costs no more than the others. Atlas, announcing the introduction of the range for 1 Oct., state that their new bulb will enable the photographer using colour film to get more in his picture, use faster shutter speeds, or smaller apertures. Known as "Double-lite Blue" it will be available in six-bulb packs instead of the usual five and displayed together with Types 1 and 5 in new compact counter dispensers. There is also a new showcard available with a pocket designed to take a "Photoflash" coloured booklet. *Atlas Lighting Ltd., Thorn Hse, Upper St. Martin's La, W.C.2.*



G.E.C's hot air fire lighter ignites coal in a few minutes. It will sell at about £5



Display for lighting sales



LONDON'S LATEST LIGHTING SHOWROOMS

LATEST lighting showrooms in London were completed recently at Thorn House, headquarters of Atlas Lighting Ltd. Altogether an area of 1,800 sq ft is made available for lighting equipment demonstrations, and the full possibilities of décor and control have been called into use to make the best of this space.

Centrepiece of the showroom area is a shop window which illustrates an up-to-date lighting display with the Atlas "Aurama" system (as used for Son et Lumiere) installed in miniature form to deliver a short lecture on display lighting.

The main range of industrial and commercial lighting fittings is concealed in ceiling coves, each fitting being mounted on a motorised lift panel. A floor-mounted console contains photographs and control numbers of all the fittings, and the appropriate number dialled on a

telephone type control brings the fitting selected to a convenient height and lights it. Several fittings may be lowered together to permit close comparison; a single master switch returns all lowered fittings to the ceiling at the end of a demonstration.

Colour-rendering properties of lighting are of course of great importance in shops and stores, and a full-scale colour comparator, consisting of two small rooms divided centrally by a venetian blind, enables the effects of various colours of fluorescent tubes to be compared.

Apart from the usual lighting on show, there is a small display demonstrating industrial and commercial applications of the ultra-violet tube; and architects and engineers may be helped by a demonstration of differing light outputs given by different fluorescent tubes against various backgrounds.



1. The two-section colour comparator; 2. A false ceiling section which can be brought to lower level to demonstrate a recessed troffer fluorescent fitting; 3. The display "window" which is accompanied by a talk on display lighting; 4. Glasses and suspensions from the "Chelsea" and "Finlandia" ranges; 5. Using the telephone dial to bring down a lighting fitting for demonstrations

News of the Week

TWO BOARDS RAISE TARIFFS

10% in South Wales : 5% in South East

SHARP confirmation for Sir Robertson King's forecast that electricity tariffs will have to rise comes from two electricity boards this week. Announcements followed urgently on the publication of their annual reports and it is expected that other area boards will follow, some chairmen having already given warnings. The South Wales EB announce that from the beginning of October prices of domestic and commercial units will have their primary rate raised from 5½d to 6d and this price will have to be paid on a higher consumption of 13 units per room instead of 12 units per room under the existing tariff. The final domestic rate for electricity, at present 1d, will be raised to 1½d.

A similar increase will also take place in the commercial block rate, with the primary units going up from 5½d to 6d and the final rate to 1½d. The floor area basis of the primary block will not be changed. A new farming tariff is also introduced of a three-block type in which the first 65 units per quarter will be charged at 6d, the next 65 units at 3d and the final price 1½d.

These increases should bring in approximately an additional £1 million, in a full year. For the current year the new rates in general will apply only to billing after 1 Jan.

The Board point out that the need to raise prices was forecast early in 1959 and the recent increases in the price of coal and in salaries and wages has made these tariff revisions urgent. In the Board's accounts for the year 1959-60 a surplus of £555,172 was recorded, but it is pointed out that the Board is self-financing its capital requirements to the extent of 44% only. A higher level of self-financing is needed if a 48% ratio is to obtain for the industry as a whole. These tariff increases have received the approval of the South Wales Electricity Consultative Council.

Seeboard's Increase

INCREASED tariffs announced by the South Eastern Electricity Board operative from 31 Oct. do not cover the latest coal price increase, the Board states. In the domestic tariff, quarterly charges are raised 2s 6d and the unit rate from 1½d to 1½s. The latter unit price increase also applies to the farm and installed load tariffs.

On the brighter side the two existing off-peak rates of 0·9d and 1d p.u. are replaced from 1 Nov. by three rates of 0·85d, 0·95d and 1d p.u., with consumers on the latter figure also having the advantage of an afternoon boost for their night-storage heating. The Board is also reducing by an average of 12½% its charges to local authorities for street lighting maintenance.

Eire also Raises Tariffs

DEFICITS for three years running, rising to £430,000 in the last year, has forced the Eire Electricity Supply Board to revise its charges. Rural electrification is blamed for the loss which has been growing with the number of areas supplied and the loss would continue to grow until the present programme finished.

The new increases will provide about 5% additional revenue. The actual changes are of considerable complexity and cover most tariffs. Two-part tariffs will have increased fixed charges of 6d to 1s per month and, while the primary rate of block tariffs is left unaltered, the final price per unit will be raised from 1½d to 1½s. The cost of commercial lighting and industrial power will also be increased but there will be no rise for water heating, commercial cooking or industrial process heating. Off-peak tariffs are unchanged.

Expanding Overseas Interests

THE Electrical Apparatus Co. Ltd. have established a subsidiary, Electrical Apparatus Co. (South Africa) (Pty) Ltd. with stock and sales/service facilities, at 38 Mewett St, Ophirton, Johannesburg.

THE directors of Midland Electric Manufacturing Co. Ltd. have acquired an interest in Pritchett Pty Ltd., of Sydney, NSW, Australia, switchgear manufacturers. Mr J. Thornell, who represented MEM in Australia for many years, will continue his connection by representing the company on the board of directors of Pritchett Pty Ltd.

Pyrotex World Rights

AS from this month, Pyrotex Ltd. have taken over world selling rights of the m.i.c.c. cables, whether produced in the French, English, Canadian or Australian factories. This results from a new agreement with the French companies, Societe Alsacienne de Constructions Mecaniques and Le Conducteur Electrique Blinde Incombustible, the licensors of the original patents. Until now the activities of Pryotex Ltd. have been restricted to the UK and the British Commonwealth. The business was started here in 1936 and was turned into a public company in 1954. There are subsidiary companies in Canada (with a factory in Toronto), in Australia (with a factory in Melbourne), and an associated concern in New Zealand.

Ericsson-Bendix Link

UNDER an agreement concluded between the Instrument Division of Ericsson Telephones Ltd. and the Bendix Corporation of America, a new company is being formed with the title of Bendix-Ericsson UK Ltd. to be located at Nottingham. This jointly owned concern will manufacture and market a wide range of high precision instruments and electronic devices. The aim is to expand the sales of existing products and to make additional products under licence from the parent companies. Managing director of the new concern will be Dr J. H. Mitchell, research director of Ericsson Telephones.

Electrolux Dishwasher?

IT is commonly believed that Electrolux are planning to widen their range of electrical appliances. The fact that an Electrolux dishwasher is already on sale in some continental countries suggests that this might be one of the first appliances to be introduced. However, due to differing kitchen practice in this country, the design would require modification, so it may be several months before a model can be launched here.

Green-Yellow For Earth Cores

THE earthing core of flexibles will in future be identified by a combination of yellow and green. That was agreed to by 15 European countries at the recent CEE meeting, including the UK, but countries may keep their national colours. This will avoid the danger of incorrect connections when appliances are imported from foreign countries. Last year attention was drawn particularly to flexibles imported from countries where red is the standard

for the earthing core. In addition it was recommended that the other two cores of the flexible should be coloured blue and black, but the UK could not subscribe to this resolution because of the views of the IEE wiring regulations committee. Therefore, the future flexibles colours will be green-yellow or green, red and black in this country, and green-yellow, blue and black applying in the fourteen other countries.

S.W.E.B. District Managers Lose Claim

THE claim that the 13 district managers of the South Western Electricity Board (where sub-areas were eliminated on 1 April, 1958) should be placed on Grade 7 of the Managerial and Higher Executive Scale, instead of Grade 6, has been rejected by the Arbitration Court. The boards contended that the South Western Board was not organised on a two-tier basis and that the district managers were upgraded from Grade 5 to Grade 6 in April, 1958, "in recognition of their increased responsibility consequent upon the abolition of sub-area managers." They submitted that Grade 7 for district managers was introduced only to meet the position in the London Electricity Board (which, between 1953 and 1957, had disbanded their sub-area organisation). In the LEB there was a clear-cut two-tier organisation with headquarters and districts and no intermediate levels of staff. The LEB did, however, have four management officers whose main duties were to see that district managers, while exercising the maximum of responsibility and initiative, conformed with the Board's policy.

The LEB district managers, it was submitted, were responsible for the proper management and co-ordination of operations within their districts and had direct access to the chairman and deputy chairman. The four management officers were concerned with general management and co-ordination of operations. With the disappearance of sub-area managers the district managers had acquired some increase in executive authority for capital expenditure, a slight increase in responsibility for staff appointments and the right of access to the chairman.

In the SWEB, with the disappearance of sub-area managers, the district managers had acquired some increase in executive authority for capital expenditure, a slight increase in responsibility for staff appointments and the right of access to the chairman.

These increases in responsibility were qualified by having (a) two group advisers

to guide and advise district managers and maintain personal liaison between the chairman and district managers; (b) chief officers at H.Q. exercising functional co-ordination through group officers; and (c) group officers extending to district managers the same assistance as they did when they were sub-area officers. The present SWEB organisation could not be described as being fully two-tier, but rather as two-tier on managerial matters and three-tier on functional matters, it was contended by the Board's side.

While agreeing that the organisation of the South Western Board differed in some respects from that of the LEB, the associations maintained that the SWEB became a two-tier organisation in respect of managerial responsibility from 1 April, 1958. The latter's group staff now acted as headquarters staff and were outstationed for geographical reasons only, they claimed. They had no executive authority over district managers, whose direct responsibilities were equivalent to those operating under the LEB two-tier organisation. SWEB district managers received no advice, instructions or assistance which would not be given by headquarters in a two-tier organisation.

The argument that the functions of the four LEB management officers were not unlike those of the SWEB's group advisers was unacceptable in that the latter were advisers with no executive or managerial responsibilities, whereas the LEB management officers had executive authority, the associations contended.

The SWEB district manager was now performing duties previously undertaken by the sub-area manager, and the associations did not agree with the Board's view that there had been little transfer of actual responsibility.

Engineers Claim £1 Rise

A CLAIM for an increase of £1 a week in pay for their members was submitted by the Confederation of Shipbuilding and Engineering Unions last week. The management board of the Engineering and Allied Employers' Federation subsequently considered the application and are now seeking the views of the 46 member associations on the matter. Their reply is expected some time next month. In fact the unions first submitted a claim for a "substantial increase" last June.

At last week's meeting, Mr W. J. Carron, president of the AEU, supported the claim with arguments on increased production, gross profits and a rise in the cost of living.

OFFICIAL PUBLICATIONS

Industrial Court Award—South Western Board—district managers—claim for upgrading. HMSO. 8d (see page 534).

Electrical Accidents and their Causes, 1959. HMSO. 5s 6d (see page 512).

Fourth Report of the Mobile Radio Committee. HMSO. 9d (see page 536).

Select Committee on Nationalised Industries (Rail Modernisation). HMSO. 22s 6d (see page 536).

Electricity (Scoteco Pension Fund) (Winding Up) Regulations, 1960. S.I. 1724. HMSO. 3d (see page 537).

Switchgear for Turkey

A BRITISH company has been successful in obtaining contracts valued at £65,000 for switchgear in connection with new oil refineries being built in Turkey. The successful company was South Wales Switchgear Ltd. who, on 25 July, entered into a £20,000 contract for equipment to be installed at Istanbul and, a fortnight later, received a further contract for £45,000 worth of switchgear and ancillary equipment to be delivered to the Atlas refinery being erected near Mersin.

The refineries are being built by Kellogg International Ltd. for the Caltex Oil Co. at Istanbul and by the Foster Wheeler Organisation for the Standard Oil Co. of New York at Mersin. The former contract is for one 15-panel and one 8-panel switchboard rated at 150 MVA, 3.3 kV, both of single busbar air insulated indoor pattern.

The latter is for two sets of switchboards rated at 250 MVA, 6.6 kV single busbar air insulated pattern interconnected by 1,000 amp trunking, and a 13-panel control board.

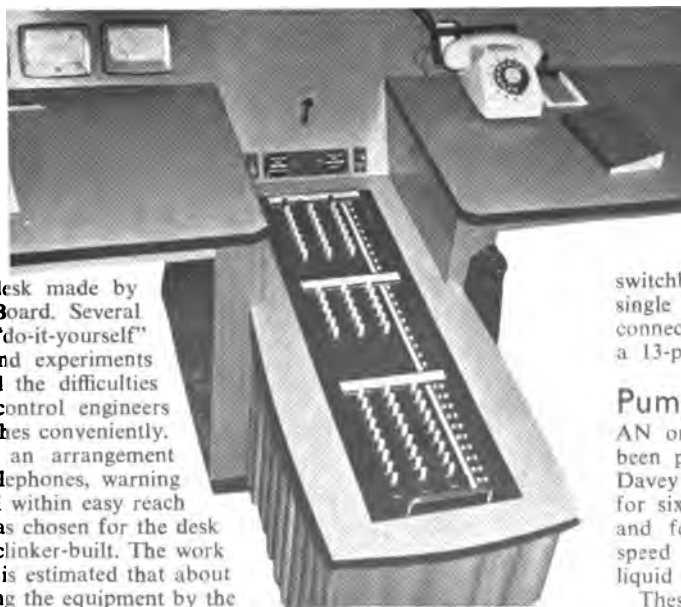
Pump motors for Blyth "B"

AN order valued at over £176,000 has been placed with the GEC by Hathorn Davey and Co. Ltd., the pump makers, for six 2,150 h.p. booster pump motors and four 4,750 h.p. stand-by variable speed boiler feed pump motors with liquid controllers.

These are required for the new "B" station under construction at Blyth.

Do-it-yourself Control Desk

THE new system control building of the Chiltern's sub-area at Sundon is equipped with a control desk made by engineers of the Eastern Board. Several people had a hand in this "do-it-yourself" effort, shown alongside, and experiments with the prototype showed the difficulties of designing so that the control engineers were able to reach all switches conveniently. After several experiments an arrangement was found in which the telephones, warning lights and switches were all within easy reach of hand or eye. Formica was chosen for the desk surface and the sides were clinker-built. The work took several months and it is estimated that about £1,000 was saved by building the equipment by the area board staff.



BOARDS' APPLIANCE SALES

UGH the boom in sales of electrical appliances largely sub- with the imposition of hire-pur- controls last April, the sales figures various electricity boards provide ng evidence of their part of the on which occurred in the 12 ended 31 March last. Sales of refrigerators and washing s of eight of the 12 boards in l and Wales, set out, right, show id in the respective areas and, these, although the Eastern ad the largest sales of cookers rigerators, the Yorkshire Board l a 39% increase in cooker sales, r washing machines and 190% gerators. shing machine sales, the North Board achieved the highest total

Appliance sales in year to 31/3/60

Area Board	Cookers	Refrigerators	Washing machines
South Western ...	27,147	10,144	8,351
Eastern ...	45,383	34,126	24,011
East Midlands ...	22,026	6,668	7,052
Midlands ...	30,188	17,914	23,330
Merseyside & N.			
Wales ...	28,881	8,034	13,032
Yorkshire ...	33,202	8,783	12,920
North Eastern ...	20,796	5,115	8,498
North Western ...	44,001	15,378	25,387

among those given and that Board also sold 28,179 vacuum cleaners, 16,043 clothes driers and 29,350 fires and heaters, we are told. Of those boards for whom specific figures are not available, the South Eastern Board's refrigerator sales in- creased by 96.9%, while cookers rose by 16.5% and washing machines by 26%.

"Servis" in Eire

S" washing machines are to be t the Dunleer, Co. Louth, Eire, of AET. This is the result of cement just concluded between eral Electric Co., of Ireland, and and Mitchell Ltd. Initially, at e idea is that the factory will for the Irish market, but at l reception given by the directors companies in Dublin last Thurs- Hilliard, Minister for Posts and hns, expressed the hope that the s of Wilkins and Mitchell would ous consideration to the incen- fered by the Eire Government matter of exports from that He felt that they might find it geous to have a portion of their trade catered for from an Irish

E.F.T.C. move

offices of the Electrical Fair Council at Sardinia Hse, Sar- , W.C.2. have been vacated due termination of the lease. Until notice the Council is operatingemble Hse, Kingsway, W.C.2. ne 8000, extension 162.

NEW FACTORY FOR YORK SHIPLEY

YORK SHIPLEY LTD., the industrial and commercial refrigeration firm, are setting up a new factory on a 20-acre site at Basildon, Essex. It is planned in the first phase of the expansion to transfer manufacture of the smaller hermetic and belt-driven condensing units, automatic ice-maker production, and other sections concerned with the assembly of commercial refrigeration equipment.

Nuclear link-up title

UNITED POWER CO. is the title chosen for the new concern which is to link the GEC-Simon-Carves nuclear- energy group with Atomic Power Con- structions. The intention to join up was reported in our 30 June issue. The new concern has a nominal capital of £100,000 in £1 shares, split equally be- tween the two groups. It has been formed with the object of designing and build- ing nuclear power stations in the UK.

Refrigerator Deliveries in August 17½% down

MANUFACTURERS' deliveries of domestic refrigerators to the home market in August were 17½% down on the same month of last year. The Domestic Refrigeration Development Committee now states that deliveries in that month totalled 53,930, compared with 65,489 a year earlier. The figure is also considerably below that for July —97,965. Total deliveries in the first eight months to the home market are, however, still 30% up on the same period of 1959—805,338 against 617,428. Exports also continue to rise, deliveries for August amounting to 7,649—an in- crease of 40% on a year ago. Total for the first eight months of the year is 95,533—42% up on the 1959 period.

Sterne's cut production

BECAUSE of reduced requirements of certain customers at home and abroad, L. Sterne and Co. Ltd. have cut back production in their hermetic unit division which manufactures sealed motor com- pressor units for refrigerator firms. About 175 employees at the Hillington factory are being laid off. That division has been employing some 1,200 men, with output running at over 3,000 units a day. The latter figure is being reduced to just over 2,000 a day.

TAKEOVER NEWS

DELTA METAL CO. LTD. have made an offer for the 688,080 Ordinary 5s shares of Sperryn and Co. Ltd., manu- facturers of lampholders, etc. They offer one Delta 5s share for each Sperryn share. Delta Metal are also negotiating for the acquisition of G. H. Edwards, a brassfoundry concern. HONEYWELL CONTROLS LTD. have acquired the share capital of New Elec- tronic Products Ltd., whose products in- clude the Melrose artificial heart and lung machine. NEP will continue to operate separately under the present managing director, Mr Z. F. Kellerman.

RGE TRANSFORMERS OR CROSS-CHANNEL SCHEME

indication of the size of the two rectifier mers for the cross-Channel d.c. power link ade at the Walthamstow works of Fuller Ltd. may be gauged from the photograph le, taken during a visit by CEGB senior The latter are standing in front of the ection of the tank for one of the trans- . Left to right are: Messrs P. H. W. (works director), J. L. Egginton, F. H. S. A. J. Haselfoot (director and chief), E. S. Booth and D. S. Young (sales). Individual transformer output is i MVA, three phase, 50 c/s. Each has indings, giving no-load ratio of 284/83.6/ with a tapping range ±15% controlled by r resistor transition on-load tap changer.



Cable Fault Caused Fire, says Jury

AN electric fault in a cable was the cause of the fire at a Liverpool store which caused the death of 11 people. There was insufficient evidence to disclose the cause of the fault. That was the decision of the jury last week, given in the form of a rider to a misadventure verdict at the end of an 11-day inquest. Another rider recommended that all electrical installations should be exhaustively tested and test certificates produced before the circuits were energised. Before submitting these recommendations the foreman of the jury referred to the electrical installation saying there was no evidence of "reckless negligence" during installation.

During the inquest there has been a clash of expert opinion on several questions of electrical engineering. One was whether the fire could have started in the cable, another on the current at which the fuse protecting the cable had blown. Summing up, the Coroner had told the jury that they had a statutory duty not to frame their verdict in such a way that civil liability was determined. The Coroner recalled that when the fire was extinguished and the fire brigade inspected the building, they came to the conclusion the electrical fault had started the fire and got in touch with Mr D. A. Picken, the local inspector of factories. Later, Mr Picken was asked to help on the electrical side by the Coroner and "had a very difficult task." Mr Picken had described tests which decided that parting of a cable core had caused arcing which provided intense heat to set alight nearby inflammable material. Other engineers disagreed about this possibility, but, as stated above, the jury felt the matter had been decided, although they did not suggest what was the cause of the cable fault. The Coroner considered that evidence had largely disposed of the possibility that a cigarette end had caused the fire to start.

A transcript of the evidence at the inquest has been sent to the Home Office, who asked for a full investigation at the inquest so that a separate inquiry would not be necessary.

New Stafford H.Q. for M.E.B.

MORE than £1½ million has been devoted to improving and expanding the distribution system in the Stafford district by the Midlands Electricity Board in the past 12 years. This expenditure includes the changing over of about 1,000 consumers from d.c. to a.c., the conversion of the h.v. system from 6.6 to 11 kV and the extension of rural supplies.

Although this only reflects the activities of the MEB throughout its area and which have brought in their trail acute problems of office accommodation for the staff, in Stafford it has been exceptionally severe with people working as many as six in an office.

A short time ago a four-acre site was purchased from the Stafford Borough Council on which has now been erected a new depot, headquarters and offices. The building also incorporates a zonal garage for the maintenance of the Board's 800 vehicles.

Rail Modernisation Costs

WHEN we published a summary of the Rail modernisation report of the House of Commons Select Committee on Nationalised Industries (28 July), the evidence on which the committee had based its findings was not publicly available. A full transcript has now been published by HMSO. The report dealt with costs, potential return on investment, and staff recruitment questions.

South Shields Line—

Alternative route proposed

AN alternative route for the proposed 275 kV line in the South Shields area has been suggested by the CEBG. The South Shields Town Improvement Committee has recommended the TC to adhere to its objections to the scheme on the grounds that the line should be underground in built-up and residential areas. The latter proposal was described at the public inquiry three months ago by the Board's spokesman as impracticable because it would cost £1,167,000.

The route is part of a 50-mile line to run from Blyth to Lockenby, in North Yorkshire.

The Board have now suggested a route crossing the Bede Trading Estate and Newcastle Rd and following the railway via Whiteleas to the borough boundary.

UKAEA drop Icse

ABANDONMENT of plans to build a large experimental machine to investigate controlled thermo-nuclear power was announced last week by the UKAEA. Sir William Penny, member of the Authority for Scientific Research, said that the cost of the machine had risen from the provisional estimate of £1½ million to £3 million—but this was not the prime reason for its abandonment. To go on with the plan would have meant having more scientists and engineers engaged in it than was thought justified with the present manpower situation. Instead, the Authority plan a number of smaller experiments to investigate controlled thermo-nuclear physics.

MOBILE RADIO FREQUENCIES

AN early move to 25 kc/s channel spacing for land-mobile radio communication in the VHF high band is made by the Mobile Radio Committee of the Post Office in their fourth special report, published last week. The recommendation directly affects electricity boards operating VHF radio; Mr G. F. Peirson

(Midlands EB) represents them on the committee.

The report says that the high band (165-173.05 Mc/s) contains 7,800 base and mobile stations and that the total number of land-mobile stations has doubled every three years over the last 12 years. The present situation is that changeover from the original 100 kc/s channelling to 50 kc/s channelling is in progress. The committee recommend that from 1 Jan., 1961, AM equipment for all new services and new equipments for existing service should conform to a 25 kc/s specification; such equipment is readily obtainable and costs little more than 50 kc/s equipment. FM equipment from that date should also conform to the 25 kc/s specification, but present users of FM should be allowed to fit 50 kc/s equipment until 1 Jan., 1966. All 100 kc/s equipment should be replaced by 25 kc/s equipment not later than 1 Jan., 1962, and all 50 kc/s equipment replaced by 1 Jan., 1966.

The report includes recommendations for allocation of individual 25 kc/s channels to various types of users. Six channels for mobile stations and two for base stations are allocated to fuel and power industries.



At the Shell-Mex and BP new Royston depot, oil is pumped direct from rail cars to storage tanks for distribution to road wagons. English Electric FLP motors—12 15 h.p., two 21 h.p. and two 5½ h.p.—drive 16 road wagon pumping sets



B.S.I.'s Hemel Hempstead H.Q. opened

The Hemel Hempstead testing centre of the B.S.I., headquarters of the approvals agency operated by B.S.I. on behalf of the Canadian Standards Association, was formally opened on 27 Sept. by the Canadian Acting High Commissioner, Mr G. Iquatieff. The agency, now ten years old, approves British electrical equipment destined for Canada. Our picture shows Mr H. A. R. Binney, B.S.I. director, left, presenting an inscribed silver salver to Mr D. Maxwell Bulist who, in 1950, led the British mission to Canada which negotiated the setting up of the joint approvals agency, and who was until recently chairman of the B.S.I. Committee on Canadian Approvals.

Minister criticised on Council Appointment

THE decision of the Minister of Power to appoint Sir Raymond Streat as chairman of the North Western Electricity Consultative Council was strongly criticised by members of the Council at

its meeting last Friday. A motion was carried expressing concern that the Minister had gone outside the 144 members of the Council and its nine district committees in making the appointment. Members of the Council emphasised that their criticisms were on the question of principle and not directed at Sir Raymond personally. (Sir Raymond retired in 1957 from the chairmanship of the Cotton Board, which he had held for 17 years, and has since accepted several business appointments.)

The Council also approved a motion expressing extreme disappointment that the Minister had not reconsidered his decision not to reappoint Mr F. Kenyon, who is 73, and has been chairman for the past eight years.

Mr Kenyon expressed disappointment that members had not been considered.

India bans some electrical goods

ELECTRICAL goods are among imports recently banned by the Indian Government for the next six months. They include house service meters, street lighting fittings and floodlights. The ban has been imposed to alleviate the drain on India's foreign exchange reserves and to stimulate utilisation of the country's own industrial resources. Also restricted are imports of wrought copper, brass and bronze.

Linear Lighting on Great North Road

THE first full scale installation of the new Mazda linear sodium lamps on a main highway in the North of England has just been completed. The site is a 2,000-yd section of dual carriageway on the Great North Road three miles north of Newcastle-on-Tyne, which is known locally as the "death mile" on account of the number of accidents which have occurred since the road was converted to dual carriageway and derestricted.

The installation comprises 43 Mazda "Amberline" lanterns mounted on 35 ft Stewart and Lloyd steel columns set back 18 in. from the kerb on the nearside of each carriageway and in the central reservation. The maximum spacing between columns is 170 ft with closer spacing at junctions and bends. Particular care has been taken in siting lanterns at intersections.

The lamp housings have been specially designed to accommodate the new lamp and present a pleasing daylight appearance. They are also economic in maintenance. The 200 W linear sodium lamp is, of course, the first lamp to achieve an efficiency of 100 lumens/W.

By its use in main road lighting, the overall illumination is doubled at only 38% increase in cost, using the usual

standard lamp columns and spacings.

Installation was completed in the remarkably short time of six weeks. The design was the work of the Castle Ward Rural District Council (surveyor and engineer, Mr G. E. Dimmack, M.I.MUN.E.) who were acting on behalf of the North Gosforth Parish Council. AEI Lamp and Lighting Ltd. were the main contractors and Abacus Engineering Co. Ltd. were responsible for erection.

Substations are a problem

TOLD that another 250 substations would be needed in Cardiff to meet the city's future power demands, members of the City Parks Committee suggested that any new substations should be installed underground. They had criticised the substation constructed by the South Wales Electricity Board at Robinson Sq, Splott, which was described as a monstrosity. "It has four walls and an iron door and no other part of the city would stand for it," one member declared.

The Committee agreed to the suggestion of the South Wales Electricity Board that the substation should be roofed without the overhanging canopy originally suggested to avoid danger to children, but at the same time expressed displeasure about the building.

C.P.O.'s for Holme Pierrepont

COMPLAINTS that the CEGB had applied for compulsory purchase orders for land at Holme Pierrepont long before the public inquiry into the proposals of the erection of a power station there were made at the Bingham RDC meeting. (The public inquiry is to be held at Radcliffe on 22 Nov.) At the last Council meeting the CEGB, in a letter, explained that this move was considered a time saver so that the people affected by the purchase orders, should planning permission be granted, could make their objections at the inquiry. But members of the Council accused the CEGB of "jumping the gun," contending that it made a farce of the inquiry.

Scottish pension fund wound up

THE Scotesco Pension Fund of the former Scottish Electrical Power Co. is to be wound up. A Statutory Instrument published last week provides for the transfer of all assets and outstanding liabilities to the superannuation committees of the two Scottish Boards. Hitherto, this fund has been administered by the North Scotland HEB in association with the South Scotland EB.

Increased demand for BICC "Panelec" floor-warming systems has necessitated the company's Panelec Heating Division seeking fresh accommodation to house extra staff needed. The new offices shown here at 83-86 Saffron Hill, E.C.1, were officially opened on 28 Sept.



Unions Move On Unofficial Activity

THE possibility of constitutional changes in the structure of the union side of the NJIC for the electricity supply industry which would provide for greater co-operation between the union negotiators and the rank and file was one of the main subjects discussed at last week's meeting of the union chiefs, we understand.

The activities of the unofficial shop stewards' movement which, in effect, has been undermining the authority of the union officials, has been causing concern to those officials who have no wish to see the formation of a "splinter group."

More "Silver" Trains for London Transport

ORDERS worth over £4 million for 619 further 1959 Tube stock cars to complete the rolling stock renewal programme for the Central and Piccadilly lines have been placed by London Transport. These orders are for car bodies and bogies only—much of the associated motors, traction control equipment, etc., for the cars has been on order since 1959, but further orders remain to be placed.

Of the 619 cars in the present order, 450 are to be built by the Birmingham Railway Carriage and Wagon Co. (338 driving motor cars and 112 non-driving cars) and 169 (all-trailer cars) by the Derby works of British Railways, London Midland Region.

Soviet Welding Tour Ending

THE Soviet Welding Delegation led by Dr B. E. Paton which has been touring British works since 16 Sept, is returning to Moscow next Saturday. This has been a reciprocal visit to that by a British Delegation to the USSR last June. At a meeting in the BEAMA offices, London, recently, the two delegations met to exchange views.

Sayings OF THE WEEK

"It is very easy for television to be audible wallpaper." . . . Mr L. MIALl, BBC TV Talks Department, speaking to the Batti-Wallahs' Society.

"We are not satisfied with the voltages some consumers are getting nor with the reliability of their supply." . . . Mr A. N. IRENS, chairman, South Western Electricity Board, speaking on the Board's report.

"The regulations which are statutory in factories are very conservative indeed, and the standard of lighting which results from strict adherence to the minimum permissible values is not good lighting by modern standards." . . . R. G. HOPKINSON, head of the DSIR Lighting Section, at the Conference on Ergonomics.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Tuesday, October 4					
	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	226½	-5½	ZINC, virgin, min. 98% purity (cash) ...	87½	+½
" (3 months) ...	228½	-4½	" (3 months) ...	87½	+½
LEAD, refined pig. 99-97% purity (cash) ...	68½	—	RUBBER, per lb No. 1, RSS, spot c.i.f. basis, ports. Dec. ...	29d	—
" (3 months) ...	70	+1	ARMOURING: Galv. Steel Wire (0-104 in.) ...	66½	—
TIN, refined, min. 99-75% purity (settlement) ...	802	-3	Mild Steel Tape (0-04 x 1½ in.) ...	53½	—
" (3 months) ...	798½	-3½	NICKEL (home) ...	600	—
ALUMINIUM, ingots 99-99-5% wire bars (4 x 4 x 54") ...	186	—	MERCURY (7½ lb flask) ...	70	+1
BRASS Strip 63/37 ...	193½	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	31c	-2c
SILVER (Troy oz) ...	200½	-6½	Lead, (New York) ...	12c	—
	79½d	—			

* Tape Price, now an average, includes varnishing

Market for Cookers in W. Germany

A LARGE potential market for electric cookers exists in W. Germany. According to a report made by the British Embassy in Bonn, only one in every three German households has an electric cooker. Although in Germany electric cooking is more expensive than by gas, it is widely recognised as being cleaner and safer. Demand, on the whole, has been for smaller cookers having hotplates only, but there is a growing trend towards larger "luxury" models as known in this country, incorporating oven, grill and quick-heating plates together with refinements such as oven light and automatic timing. Foreign firms wishing to sell in the Republic would, however, be competing with about 26 indigenous firms. To enter the market it would be necessary to set up a selling organisation in

the country backed by extensive advertising. But to keep a foothold in this market, the report emphasises, manufacturers concerned must be alive to new ideas, pay strict attention to design and up-to-the-minute appearance of their products while at the same time keeping prices competitive.

Order from Uganda

BELLISS AND MORCOM LTD. have won a contract for a 3,000 kW back-pressure turbo-alternator set for a sugar refinery in Uganda. As main contractors, that firm is responsible for all the power generation equipment which includes the alternator exciter and main step-up transformer to be supplied by the General Electric Co. In the face of heavy competition, price, efficiency, quick delivery and past performance secured the order.

E.I.B.A. Golf

AT the annual Electrical Industries' National Golf Championships at Birmingham last week, Mr B. Rolfe won the Sir Montague Hughman trophy and the J. Y. Fletcher cup. Runner-up was Mr W. M. Hawsworth who received the J. L. Wilson cup. Winners of the Sir Felix Pole Foursome trophies were Messrs H. Fletcher and F. C. Lucas, runners-up being A. S. Lee and L. Bowen. At Sutton Coldfield the EWF Visitors' trophy was won by Mr B. R. Fletcher, with W. G. Ellson runner-up. The Veterans' trophy was won by Mr L. H. Welch, runner-up being Mr G. F. Sills.

News in Brief

The whole of the borough of Barnes has now been changed over to a.c. Portishead Council are planning a new swimming pool with electric heating. With the completion of new street lighting in 4½ miles of roads, Willesden Town Council have approved a £24,000 contract for another lighting scheme involving Neasden La and Dudden Hill La. Ekco-Ensign Electric Ltd. recently held their annual sales conference at the Abbey Hotel, Malvern.

Trade in August

FOR the first time since March, 1958, the hire-purchase debt fell in August—from £971 million to £970 million. The amount owed directly to household goods shops dropped £4 million to £328 million. But the Board of Trade states that retail sales generally were fairly well maintained in August, the index of the total value of sales (seasonally adjusted) being 110 for the month, as against 112 for July. For independent radio and electrical shops the index was down 6%, and for department stores 3% down.

Batti-Wallahs' Luncheon

SPEAKER at last week's monthly luncheon of the Batti-Wallahs' Society in London was Mr L. Miall, of the BBC Television Talks Department. He dealt wittily with the policy of BBC TV in the "serious" programme field, saying that the Corporation had kept up the level of about one-third serious material during peak viewing hours. He also paid tribute to the help advances in electrical and electronic engineering had given the programme organisers by making possible compulsive up-to-the-minute reporting. The next luncheon of the Society is to be held on 27 Oct.

Company Activities

THE electrical industry came into the limelight with a vengeance last week. Overshadowing all other Stock Exchange business was the news that the General Electric Co. and the English Electric Co. were to "explore immediately" the possibility of a merger. The companies have in mind the formation of a holding company and if the scheme comes to fruition the new group would have net assets of £177 million and employ 154,000 people. As such it would be even larger than Lord Chandos' Associated Electrical Industries, which has £166m net assets.

The shares of GEC have been an active market lately on rumours that a tie-up with another big group was in the offing. But the other company most frequently mentioned in this connection was Sir Joseph Lockwood's Electric and Musical Industries. The appearance of English Electric in the field was something of a surprise, but it seems well suited to team up with GEC. Suggestions that English Electric might take over all "heavy" business with GEC absorbing the rest have been denied. This is not surprising. GEC has substantial interests in the nuclear power field which would no doubt prove difficult to unravel. It would also clearly be to the advantage of any new organisation to retain the goodwill attaching to the English Electric and General Electric names. A spokesman for GEC has said that the greatest scope for the new giant would be in domestic appliances and electronics, and the long-term effects of the plan on other producers could be far-reaching. The terms of a merger are not likely to be known for several months.

In all the excitement the acquisition of Ardenite and Ardenite Acoustic Laboratories by EMI went almost unnoticed. But it is an important landmark all the same and will give EMI control of a

thriving business manufacturing hearing aids and miniature electronic components. By all accounts it is the latter which interest EMI most and Sir Joseph Lockwood's money bags are likely to be used to develop this side to serve the group's computers and missiles. For all this EMI paid about £610,000 which is regarded as cheap and a better bargain than the recently acquired Morphy-Richards business.

Even that was not the end of last week's take-over news. Pye, which swallowed up the Telephone Manufacturing Company a few weeks back, announced a private placing of £3 million 6½% debenture stock 1980-85 at par. It came as no surprise. Pye chairman, Mr C. O. Stanley, had previously stated that he was not in favour of a rights issue to finance the completion of the Telephone deal. Financially it was sound policy, for good class debentures with a high running yield have been in demand in the market. One of the features of dealings last week was a genuine investment demand for gilt-edged issues with War Loan 3½% especially favoured. American buying has been largely responsible for this show of strength. Interest rates in the United States are now so low that short-term funds are even being attracted by British Government stock as well as normal holdings of Treasury Bills.

Another talking point in the City has been the increase in prices foreseen by the chairman of the Electricity Council—a step which has almost been forced on the industry by more expensive coal and higher wages. The increase in coal prices is expected to have a purely marginal effect on fuel usage and by 1965 consumption of coal should be 8-10 million tons higher. Demand for electricity is expected to rise about 45% in the next five years.—*From our City Correspondent.*

Ada (Halifax) Ltd.

Philips Electrical Industries say they have received acceptances or such intimation in respect of approximately 70% of the Ordinary capital of Ada for which they offered 3s 9d a share (which we reported on 8 Sept.) and the offer is now unconditional. Meanwhile, dissatisfied shareholders claiming the support of holders of 1½ million of the 11 million 1s shares want an extraordinary general meeting, and are considering an application to the Board of Trade for the appointment of an inspector to investigate the company's affairs. It is also revealed that Longford Electric Co. at one time considered making a bid for Ada.

Bell's Asbestos and Eng. (Holding)

It is proposed to raise approximately £1 million in a rights issue to repay bank overdrafts and provide additional

group finance. Price of the issue is to be announced later. These new shares will not participate in the 7½% interim. On the information at present available to them, the directors anticipate that profits for the current year will exceed those for 1959.

Bennis Combustion Ltd.

There is no dividend on the Ordinary for the year ended 30 April last. Operations for the period resulted in a group trading loss of £3,025 after writing back unrequired provisions in respect of contracts now completed and after adjusting for unrequired provisions for deferred repairs by a subsidiary. In the previous year there was a profit of £23,671.

George Cohen 600 Group

Terms of the proposed rights issue will

be announced in November, if market conditions are suitable. Mr C. M. Cohen, chairman, told shareholders at the annual meeting last week. He gave an assurance that if, at some future date, it is proposed to issue all or part of the remaining £1,625,000 of Ordinary capital in circumstances which would result in a radical change either in the control of the company or the nature of its business, the matter will first be referred to the stockholders.

Holophane Ltd.

With profit for the year ended 30 June last increasing slightly to £105,777 (£97,139), final dividend is raised 4% to 24%, making the total distribution 30% (26%).

K.G. (Holdings)

The chairman, Mr P. R. V. Wheeler, expects the results for the year to 31 March next to show an improvement over those for 1959-60. The subsidiary, F. H. Wheeler and Co., in particular, has a very considerable increase in work in progress.

F. McNeill and Co. Ltd.

This concern's two cable companies—General Cable Manufacturing Co. and Britannic Cables Ltd.—incurred an appreciable loss in the six months ended March last, and the latest available figures disclose that a further loss was sustained in the following three months, the directors report. Mr C. W. R. Pantlin, the chairman, states that it was not possible that there would be any improvement until October. If the expectations of the board are fulfilled, the results of the cable group for the year ending September, 1961, should indicate that, provided no special circumstances intervened, they will have weathered the storm and returned to a profit-earning basis.

Radio and Television Trust

Order books are at a satisfactory level and the main difficulty is to obtain sufficient personnel, the directors report. In particular, the development departments are being strengthened. Earlier this year, the company acquired the capital of British Communications Corp'n. Ltd. and the full accounts shows £121,003, out of a total of current liabilities of £331,213, as being due to former holders of BCC.

Scottish Cables (South Africa) Ltd.

The trading profit for the year to 30 June last is £183,903 (£134,224) and the dividend is 12½% (10%).

Dividends Declared

Drayton Regulator and Instrument Co. Interim 7½% (same).

Ericsson Telephones. Interim 4% tax free (same).

Muirhead and Co. Interim 2½%.

Superheater Co. Interim 4½d per share (same).

Telephone and General Trust. Interim 5% (against equivalent of 4½%).

Sturtevant Engineering Co. Interim 3% tax free (same).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

- 6 Oct.—Belfast C.C.** Lift installations in proposed College of Art.—See 22 Sept. issue.
- 6 Oct.—Cardiff C.C.** Erection of 1,260 Class "B" concrete columns and complete installation of 80 W mercury lanterns/gear, on fixed-price basis, contract 6.—See 22 Sept. issue.
- 6 Oct.—Oswaldtwistle U.D.C.** Renewal of electrical installations in 22 houses, Central Ave. Surveyor, Town Hall, Union Rd.
- 7 Oct.—Dun Laoghaire.** Supply and erection of two 3½-ton cranes.—See 15 Sept. issue.
- 7 Oct.—Ilkley U.D.C.** Supply, erection and putting into service of 3,100 yd of 400 W colour-corrected mercury m.v. lighting on steel columns complete with control gear, fuses and brackets for A65 lighting.—See 15 Sept. issue.
- 7 Oct.—N.I. Housing Trust.** Electrical installations in (a) 61 dwellings at Ballyclare No. 2; and (b) 64 dwellings and one shop at Whitehead No. 3.—See 29 Sept. issue.
- 7 Oct.—Southport B.C.** Electrical installation at Floral Hall.—See 1 Sept. issue.
- 8 Oct.—Chilton P.C.** Supply of 21 sodium vapour and ten tungsten lamps/brackets/gear for trunk road lighting.—See 15 Sept. issue.
- 8 Oct.—East Kesteven R.D.C.** Provision of additional power and lighting points included in modernisation of (1) 72 houses at Ruskington and Anwick; (2) 79 houses at Ashby and Blankney Fen; (3) 66 houses Gt Hale and Heckington; (4) 72 houses at Aunsby, Burton and Pedwardine; (5) 75 houses at Billinghay and N. Kyme; and (6) 28 houses at Cranwell, Leasingham and Wilsford.—See 29 Sept. issue.
- 8 Oct.—Ellesmere Port B.C.** Provision and erection of 34 Group "A" concrete columns/lamps complete, contract No. 298, for A41 Chester/Birkenhead Trunk Rd. Borough Engineer and Surveyor, Queen St.
- 8 Oct.—Haslingden B.C.** Rewiring of power circuits in 44 houses, Free La, Helmshore, and Cedar Ave, Haslingden.—See 15 Sept. issue.
- 8 Oct.—Ilkley U.D.C.** Rewiring of 28 houses at Menston.—See 22 Sept. issue.
- 8 Oct.—North Wiltford R.D.C.** Contract 2. Supply and erection of duplicate 100 g.p.m. sludge pumps. Contract 3. Supply and erection of duplicate 20 g.p.m. and duplicate 100 g.p.m. ejectors, all complete with motors, starters and accessories.—See 15 Sept. issue.
- 10 Oct.—Armagh C.C.** Electrical installation in Keady County Secondary Intermediate School.—See 15 Sept. issue.
- 10 Oct.—Belfast.** (1) Electrical installation in proposed pavilion at Ballywonard, Glemgormley, for Board of Governors of Belfast Royal Academy. Details from architect: A. Dorman, 8 Elmwood Ave, Belfast.
- 10 Oct.—Bristol C.C.** Supply and erection of dual fuel sludge gas/diesel engine alternators, 750 b.h.p./525 kW at 3.3 kV 3-ph., together with associated waste heat recovery plant, switchboards, switchgear, transformers and cables.—Advertised 22 Sept. issue.
- 10 Oct.—Bury C.B.** Electrical installation in public library.—See 29 Sept. issue.
- 10 Oct.—Camberwell B.C.** Provision of Group "A" 200 W sodium lighting on steel columns in place of existing lighting: A221, six 140 units (112 new, 28 retained); A2208, 12 units (nine new, three retained). Replacement on existing columns: A2, 70 units; A202, 108 units; A215, 98 units.—See 22 Sept. issue.
- 10 Oct.—Chorley B.C.** Installation of landing lighting in 51 dwellings. Borough Engineer, Town Hall, Deposit £1 ls.
- 10 Oct.—Merton and Morden U.D.C.** Supply and erection of 80 Class "A" mercury vapour and sodium lanterns/gear/wiring units on 25 ft concrete columns along Wandle Rd, Green La and Middleton Rd.—See 29 Sept. issue.
- 10 Oct.—Thorney P.C.** Erection of 19 Group "A" steel columns and 140 W sodium lanterns/equipment.—See 22 Sept. issue.
- 11 Oct.—Bilston B.C.** Installation of lighting and power points in 40 pre-war houses. Housing Director, Municipal Bldgs, Hall St. Deposit £2 2s.
- 12 Oct.—Aycliffe D.C.** Supply of (List 5) electrical goods for erection of 132 houses.—See 29 Sept. issue.
- 12 Oct.—Peterborough T.C.** Lighting and power installations in 98 dwellings on Bluebell estate.—See 29 Sept. issue.
- 13 Oct.—Northwich R.D.C.** Supply and erection of 206 Group "B" 15 ft concrete columns, 290 lanterns/control gear and resetting of existing columns.—See 22 Sept. issue.
- 13 Oct.—Stornoway Pier and Harbour Commission.** Electrical work in erection of Customs Hse/Government offices/two dwellings in South Beach/Quay St. Applications to architects: Gratton and McLean, 21 Woodside Terr, Glasgow, by above date.
- 13 Oct.—Tyrone C.C.** Electrical installation in Old People's Home, Omagh.—See 29 Sept. issue.
- 13 Oct.—Warrington R.D.C.** Provision and installation of Class "B" lighting standards in various parishes.—See 22 Sept. issue.
- 14 Oct.—Belfast C.C.** Supply of vertical fluorescent street lighting lanterns and brackets.—See 22 Sept. issue.
- 14 Oct.—Ellon B.C.** Supply and erection of 21 Trunk Rd A92 lighting units.—See 29 Sept. issue.
- 14 Oct.—Glasgow C.C.** Supply of 450,000 yd p.v.c. aerial cable.—See 15 Sept. issue.
- 14 Oct.—Hitchin U.D.C.** Erection and commissioning of 30 Class "A" and 65 Class "B" lighting units in various areas. Council Surveyor, Council Offices, Brand St.
- 14 Oct.—Maldstone B.C.** Scheme PW9, electrical installations in 24 flats in four blocks on Parkwood Housing estate. Borough Engineer, Palace Ave.
- 14 Oct.—Ross and Cromarty C.C.** (g) Electrical work in erection of two blocks of two four-apartment houses at Tore, Black Isle. Applications to quantity surveyors: R. Armour and Partners, 375 Union St, Aberdeen, by above date.

17 Oct.—Cardiff. Supply of 400/440 V spark erosion equipment. Clerk to Governing Body, Welsh College of Advanced Technology, City Hall.

17 Oct.—Chelmsford R.D.C. Provision and erection of 64 Group "A" 25 ft concrete columns/brackets and 140 W side entry sodium lanterns/lamps/gear along A12 at Mountnessing, near Brentwood. Engineer and Surveyor, Council Offices, New London Rd. Deposit £2 2s.

17 Oct.—Knaresborough U.D.C. Supply and erection of 50 Group "A" concrete columns with sodium discharge lamps/control gear for Bond End/Boroughbridge Rd street lighting. Engineer and Surveyor, Knaresborough Hse.

17 Oct.—Wallasey C.B. Electrical installation in Moreton Secondary Modern School extensions.—Advertised 29 Sept. issue.

18 Oct.—Beverley R.D.C. (e) electrical installation additions to 39 houses at Newbald, Wawne, Lund, Cherry Burton, Woodmansey, Little Weighton, Skidley and Swanland.—See 29 Sept. issue.

18 Oct.—Fylde Water Board. Garstang Borehole scheme: (a) two ½ m.g.d. 170 ft head; (b) two surface pumps, 1 and 1½ m.g.d. at 320 ft; (d) cables; (e) switchboard.—See 22 Sept. issue.

18 Oct.—Littlehampton U.D.C. (Contract 24). Electrical installations in six houses, Helyer's Gn, Wickbourne estate. Engineer and Surveyor, Council Offices. Deposit £1 ls.

19 Oct.—Kirkburton U.D.C. Supply and installation of 88 200 W sodium discharge lamps on 35 ft steel columns for A629 Penistone Rd (second part) lighting.—See 29 Sept. issue.

19 Oct.—Sunderland T.C. Cable laying, 2,000 yd of 2-, 3- and 4-core p.l.c.s.t.a. cable for street lighting.—See 29 Sept. issue.

20 Oct.—Louth R.D.C. Contract 29: Supply and erection of 18,750 g.p.h. duplicate horizontal centrifugal booster pumps together with motors, starters and accessories for Kenwick Reservoir. Details from consulting engineers: John H. Haiste and Ptnrs, Belmont Hse, 20 Wood La, Headingley, Leeds 6. Deposit £3 3s, made payable to R.D.C.

21 Oct.—Bristol C.C. Supply of lamps, batteries, transformers, capacitors, sundries, cables, etc., for year from 1 Jan., 1961. City Engineer and Planning Officer, Cabot Hse, Deanery Rd, Bristol 1.—Advertised in this issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 108 queries answered this week

"Veto" switches—agents for? T.E.—Deta (Overseas) Co. Ltd., 31 Moscow Rd, Caroline Pl, W.2.

"R.E.D." irons—makers of? W.H.P.—Radio Electric Developments (Crewe) Ltd., Excelsior Wks, Walthall St, Crewe.

United States Electrical Co. Ltd., Cincinnati—agents for? G. and H.—Newage Machine Tools Ltd., 98 Croydon Rd, S.E.20.

"Coldspot" refrigerators—repairers of? M.L.—Electrical Refrigeration and Radio Engrs. (Epping) Ltd., 35 Little Russell St, New Oxford St, W.C.1.

"Limpet" insulating tapes—makers of? A.E.I.—Connollys (Blackley) Ltd., Blackley, Manchester 9.

"Wyndson" recorders—address for? P.I.—Magnetic Recording Co., 2 Bellevue Rd, N.11.

"Ultra" hair dryers—repairers of? E.M.E.B.—Eugene Ltd., 90 Avenue Rd, W.3.

"Genil" immersion heaters—makers of? S.E.E.B.—George Nobbs (1935) Ltd., 87-89 Cleveland St, W.1.

"Fri-Fri" fish fryers—agents for? E.C.—Aga Heat Ltd., 30 Orchard St, W.1.

21 Oct.—Cork. Electrical services installation at Cork Airport. Dept. of Transport and Power, Kildare St, Dublin. Deposit £15.

22 Oct.—Bexhill B.C. Supply, erection and putting into service of 52 140 W sodium lamps on 25 ft reinforced concrete columns. —See 29 Sept. issue.

22 Oct.—Seaton Valley U.D.C. Supply and erection of 329 units and supply only of 132 units for street lighting scheme. Surveyor: T. W. Burgess, Council Offices, Seaton Delaval.

24 Oct.—Beverley R.D.C. Supply and erection of: Contract 2, two 180 g.p.m. sewage pumps and two 100 g.p.m. sludge pumps; Contract 3, four 40 g.p.m. and two 30 g.p.m. sewage ejectors for Leven and Tickton Sewerage Schemes. —See 29 Sept. issue.

24 Oct.—Billingham U.D.C. (Contract L1). Supply: 15 concrete columns, A19; (L2) supply: 69 steel columns, A19; (L3) supply: 140 W sodium lanterns/lamps/gear; (L4) supply: 400 W m.v. lanterns/lamps/gear; (L5) provision and laying of cables, servicing of columns and lanterns; (L6) erection: 84 columns/lanterns, A19; (L7) provision and laying cables, New Rd; (L8) erection: 33 columns, New Rd; (L9) provision and laying cables, Haverton Hill Rd; (L10) erection: 59 columns/lanterns, Haverton Hill Rd; (L11) supply: 92 concrete columns, New and Haverton Hill Rds. Engineer and Surveyor, Council Offices, Haverton Hill, Billingham, Co. Durham. Deposit £1 1s each contract.

24 Oct.—E.B. for N. Ireland. Supply and erection of lighting and heating for No. 3 set at Coolkeeragh Power Station. —See 29 Sept. issue.

24 Oct.—Kingston upon Thames. Roof renewal, electrical ancillary works, etc., at Corp. Depot. —See 29 Sept. issue.

24 Oct.—Pelton P.C. Erection of 30 60 W sodium lamps on concrete columns. Council Clerk, J. Glassey, Council Offices, Newfield, Co. Durham.

24 Oct.—S. Devon Water Board. Supply of 1,800 g.p.h. at a 286 ft head duplicate pumps and ancillary equipment for Sheldon Pumping Station. Chief Engineer, The Laurels, 46 New St, Honiton.

25 Oct.—Ealing B.C. (a) Supply of 88 140 W sodium lanterns/lamps/gear; (b) supply and erection of 85 25 ft steel columns. —Advertised 15 Sept. issue.

26 Oct.—Cardiff C.C. Complete £38,000 electrical installation, by contractors on N.I.C.E.I.C. roll, in proposed Teachers' Training College, Cyncoed. —See 29 Sept. issue.

26 Oct.—Whitchurch U.D.C. Phase 1. Supply, erection and wiring of 45 150 W sodium lamps on 25 ft concrete columns and 59 85 W sodium on 15 ft columns. —Advertised 29 Sept. issue.

31 Oct.—Oldham C.B. Conversion of 15 mechanical public clocks to electric drive or electric wind. —Advertised 29 Sept. issue.

5 Nov.—New Windsor B.C. Supply of (Item 15) lamps and (Item 21) fittings and cable for year to 31 Dec., 1961. Applications to Borough Engineer, Kipling Bldg, Alma St, enclosing foolscap s.a.e.

14 Dec.—Matlock U.D.C. Supply and installation complete of nine sewage pumps at four pumping stations in Darley Vale. Details from W. H. Radford and Sons, 57 Goldsmith St, Nottingham. Deposit £3 3s, made payable to U.D.C.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

2 Nov.—Pakistan. 4,000 2,500 a.h. inert dry cells. Chief Controller of Stores, Eastern Bengal Railway, Pahartali, Chittagong. B.O.T. (ESB/25196/60).*

8 Nov.—Ceylon. 15 10 kVA single-phase and four 25 kVA three-phase transformers. Chairman, Tender Board, Ministry of Agriculture, Land, Irrigation and Power, P.O. Box 500, Colombo. B.O.T. (ESB/24648/60).*

10 Oct.—Pakistan. Five d.c. motors of 4 and 5 h.p. and starters. W.P.D.A., Gardee Trust Bldg, Old Anarkali, Lahore. B.O.T. (ESB/25026/60).*

13 Oct.—Pakistan. Four 75 kVA; two 150 and two 250 kVA 3-ph. 6-6/0-4 kV transformers. Director of Stores, W.P.D.A., Gardee Trust Bldg, Old Anarkali, Lahore. B.O.T. (ESB/25066/60).*

14 Oct.—South Africa. Five 110 V and five 380 V 5 A kWh/kVAh meters. Town Clerk's Office, City Hall, West St, Durban. B.O.T. (ESB/25149/60).*

17 Oct.—Pakistan. Transformer 3-ph.: One 500 kVA 3-3/11 kV; one 1,500 kVA 11/33 kV; two 150 and three 350 kVA 3-3 kV/400 V. Director of Stores, W.P.D.A., Gardee Trust Bldg, Old Anarkali, Lahore. B.O.T. (ESB/25144/5 and 6/60).*

18 Oct.—Pakistan. 103 miles 132 kV transmission lines at Multan and Montgomery. W.P.W.P.D.A., Lahore. B.O.T. (ESB/25053/60/DLF).*

18 Oct.—Pakistan. 16,000 ft multi-core 660 V grade metal-sheathed non-draining paper insulated cable. Chief Controller of Stores, E.B. Railway, Pahartali, Chittagong. B.O.T. (ESB/25192/60).*

25 Oct.—India. Cables and accessories for up to 6-6 kV for Riverside Power Hse. General Manager, Kanpur Electricity Supply Administration, Kanpur. B.O.T. (ESB/25313/60).*

E. Anglian Hospital Board. Electrical and lift installations at West Suffolk General Hospital, Bury St. Edmunds, Norwich Electrical Co. Ltd., £7,633; and Evans Lifts, £3,740, respectively. Provision of stand-by generator and electrical work at St. Michael's Hospital, Mann Egerton and Co. Ltd., £1,815. Electrical work in Fubourn Hospital, Cambridge, new boiler house, Mann Egerton and Co. Ltd., £1,406. Recommended.

Hartlepool T.C. Electrical installations in 56 houses, John Westmorland and Co., £2,092.

25 Oct.—Pakistan. Six seven-circuit and five four-circuit l.t. switchboards. Chief Controller of Stores, Eastern Bengal Railway, Pahartali, Chittagong. B.O.T. (ESB/25393/60).*

26 Oct.—Rhodesia and Nyasaland. Six 500 kVA 3-ph. 11/0-4 transformers with option on six more. Town Clerk, P.O. Box 591, Bulawayo. B.O.T. (ESB/25118/60).*

27 Oct.—America. One 30 MVA 6-6/115 kV 3-ph. power transformer. District Engineer, U.S. Army Engineer District, 628 Pittock Block, Portland 5, Oregon. B.O.T. (ESB/25547/60).*

28 Oct.—S. Africa. Nine 12-channel and one three-channel carrier systems for S.A. Railways. Chairman, Tender Board, P.O. Box 7784, Johannesburg. B.O.T. (ESB/25561/60).*

31 Oct.—Australia. 84 s.-ph. current transformers, support structures, cubicles and cabling. Commercial Manager and Secretary, E.C. of N.S.W., Box 5357, G.P.O., Sydney. B.O.T. (ESB/25179/60).*

31 Oct.—Pakistan. 1-5 mile of three pairs 7/0-029 underwater telephone cable. Mr F. Rizwi, Purchase Co-ordinating Officer, Posts and Telegraphs Directorate General, Block 32, Frere Rd, Karachi. B.O.T. (ESB/25344/60).*

1 Nov.—Pakistan. 12 400 V a.c. motors. Chief Controller of Stores, E.B. Railway, Pahartali, Chittagong. B.O.T. (ESB/25191/60).*

4 Nov.—New Zealand. 140 W sodium street lighting lanterns. Town Clerk, P.O. Box 5045, Dunedin. B.O.T. (ESB/25387/60).*

7 Nov.—Pakistan. (1) 14 33/0-4 kV 50 to 250 kVA distribution transformers; (2) two 33 kV o.c.b.'s; (3) switches and low tension o.c.b.'s; (4) 100 miles a.c.s.r.; (5) aluminium conductor; (6) tubular steel poles; (7) 33 kV and l.t. insulators. Executive Engineer, W.P.D.A., Electricity Construction Division, Nowshera. B.O.T. (ESB/25382/60).*

7 Feb., 1961.—New Zealand. 434 220 kV double-circuit, galvanised steel transmission towers. Secretary, Tenders Committee, N.Z. Electricity Dept., Wellington. B.O.T. (ESB/25097/60).*

15 Feb., 1961.—Australia. 13 34/34/68 MVA 16/16/200 kV s.-ph. 346 kV line transformers. Superintendent of Stores and Supply, Snowy Mountains H.E. Authority, Box 332, Post Office, Cooma North, N.S.W. B.O.T. (ESB/25386/60).*

CONTRACTS PLACED

Leicester. Provision of goods/passenger lift at Royal Infirmary for Sheffield Hospital Board, Etchells, Congleden and Muir Ltd., £2,049.

Longbenton U.D.C. Supply and erection of 133 sodium vapour main road units and 21 100 W filament units, Engineering and Lighting Equipment Co. Ltd.

Newcastle-on-Tyne C.C. Electrical installation, alterations and additions at Stocksfield Ave Primary and Silverhill School, Mitchelson (Electrical) Ltd. Recommended.

Northumberland C.C. Electrical works in schools: Somervyl Primary, A. E. Jamison Ltd., £212; Longbenton C.E. Controlled, I. and E. Morton, £453; Newburn Manor Primary, Bonham Electrical Co., £276; and in Stannington Children's Hospital, G. S. Akinhead, £469 10s. Recommended.

Sheffield T.C. Lighting and power installation at Oaks Water Tower, Yorkshire E.B., £1,188. Recommended.

Welwyn Gdn City D.C. Supply and erection of 41 Group "A" tubular steel columns complete with lanterns/gear for N.W. Development Area "N," Abacus Municipal Ltd.

Wortley R.D.C. Street lighting (Schemes 54 and 57): Ecclesfield 67, Chapelton to High Green, 74 125 W m.v. on 20 ft columns, Concrete Utilities Ltd.; (Scheme 55) Stannington, 60 80 W on 15 ft columns; (Scheme 58, pt. 1) Chapelton, 29 250 W lamps on 25 ft columns, A.E.I. Lamp and Lighting.

TRADE NOTES

Agreement. Blackburn Electronics Ltd., a manufacturer of digital data handling equipment, announce that agreement has been reached between themselves and the Clary Corporation of U.S.A., for the marketing, in Gt. Britain, of the range of Clary printers and arithmetic centres.

Australian Tariffs. The Australian Minister for Trade has asked the Tariff Board to inquire into and report on whether additional assistance should be given to local producers of electro-mechanical domestic appliances with self-contained motors, such as vacuum cleaners, floor polishers and floor scrubbers. At the present time these carry a British preferential duty of 25% *ad valorem*. Any U.K. firm proposing to sub-

mit evidence should notify the Australian authorities by 12 Oct.

Ceylon Tariffs. Among items for which revised import duties are specified are vacuum and pressure gauges, pressure switches and float switches, for which the preferential rate becomes 2½% *ad valorem*, and the general rate 12½%.

Change of Name. The title of Zeta Domestics Ltd. has been changed to Gay-Day (Domestics) Ltd.

London office. The Key Engineering Co. Ltd. have opened a new London office at 2 Caxton St, S.W.1. Telephone: Abbey 4860. Mr I. K. Robinson is handling all technical and sales inquiries there.

BUSINESS PROSPECTS

Addington. Royal Warehousemen, Clerks and Drapers' Schools, Russell Hill School, Purley, Surrey, plan £½ million new school at Ballards, Addington, and scheme for modifications at existing school at £450,000.

Ashby R.D.C. 12 houses planned for Appleby Magna and nine for Measham. Surveyor.

Birmingham T.C. Tender: 20 Hollybank Rd bungalows and 11 two-storey dwellings, Adams Hill. Architect.—Tender: 27 four-storey dwellings, Tessall La; eight four-storey dwellings, Pool Farm estate. Architect.

Berwick. Tender: Ward block and physiotherapy dept., Berwick Infirmary, for Newcastle Regional Hospital Board. Quantity surveyors: Thomas Barrett, Sons and Ptnrs, High Bridge, Newcastle.

Blaby R.D.C. 92 dwellings planned in various villages for 1961. Surveyor, Shepshep.

Blackburn. D. Thwaites and Co., Blackburn, plan brewhouse and steam raising plant at Syke St, Cleaver St, etc.—Fox (Warehousing) Ltd. plan rear Hodson's St warehouse.

Bolton. The Bleachers' Association plans extensions on Back Bury Rd land.

Bracknell. Extensions planned to factories of Rascal Co., of Bracknell; Secomatic, Western Rd; A.E.A. Engineering, Western Ave; and Lennie and Thorne, Western Rd. Corporation Architect.

Bradford. Leeds Regional Hospital Board plans 600-bed hospital at Horton Green to cost £3½ million.—Remodelling of St. Luke's and St. Luke's Maternity Hospital planned.

Brandon (Co. Durham). Plans by C.W.S. Architects' Dept., 90 Westmorland Rd, Newcastle-on-Tyne, for distribution depot at Langley Moor for East Durham Co-operative Dairies.

Brighton. Horsell Electrics, 47 Hollingdean Rd, plan new factory.

Bury. Walker Chemical Co. plan new production building at Fernhill Chemical Wks.

Bury St. Edmunds. Fuller, Hall and Foulsham, 212 High Holborn, W.C.1, architects for 70,000 sq ft factory building for Barber-Greene, Olding and Co., Hatfield.

Cardiff. Turriff Construction Corp., Bedbrooke Rd, Warwick, contractors for Guest Keen Iron and Steel Co. conversion of old offices into laboratories, at East Moor.

Coventry T.C. Tender: Laundry in Livingstone Rd. Architect.

Cumberland C.C. Tender: Additional hostel accommodation at Newton Rigg Farm School, Penrith, and alterations and additions to Thornhill Primary School, Egremont. Acting County Architect: H. R. Clark, 15 Portland Sq, Carlisle.

Eastleigh B.C. Tender: 30 Velmore Housing Estate bungalows, Stage 10. Engineer.

Edinburgh T.C. Tender: Contract 8, 236 houses; Contract 10, 49 houses. Architect.

Evesham. Willmott's, Swan La, plan factory extensions on Conduit Hill land.

Grantham B.C. Tender: 101 houses. Surveyor.

Harrogate. Taylor, Brown and Miller, 8 Victoria Ave, architects for James Coombes and Co.'s planned Grove Park Terr premises.

Hornchurch U.D.C. Tender: 233 houses in two contracts. Engineer and Surveyor.

Houghton-le-Spring. Conversion of Coliseum Cinema, Newbottle St, into shop premises for Howard Collings Group of Companies. Architect: Ivor Hodges, L.R.T.B.A., 10 Gray's Inn Sq, London W.C.1.—Isaac Berriman, Fence Houses, propose housing developments at North View; similar developments are planned at Quarry Rd and Station Rd, Shiny Row, for William Leech Ltd., builders, St. James St, Newcastle-on-Tyne.

Hull T.C. Tender: 54 dwellings, Greenwood Ave area. Architect.

Irvine. Skefko Ball Bearing Co., Legrave Rd, Luton, plan factory.

Jarrow-on-Tyne. Smart and Brown (Machine Tool) Biggleswade, Beds, plan new factory.—H. Mullins, Bede Trading Estate, Jarrow, plan Curlew Rd factory.—Smith Gore and Co., 81 Bondgate, Darlington, plan housing developments on seven acres at Hedword Town Farm.

Kilmarnock. Industrial Estate Management Corporation for Scotland plan £95,720 factory, Abbotsford Rd.

Leominster B.C. Tender: 25 bungalows, laundry, bedroom block, community centre on Sydonia site. Surveyor.

Liverpool T.C. Tender: 1,639 dwellings on various sites. Architect.

London. E. Frederick E. Jones, 6 Gray's Inn Sq, W.C.1, architect for Bernard Dula Ltd. new factory at High St, Stratford, E.15.—W. Bridges and Co., 37 Parliament St, S.W.1, consulting engineers for Osborne St, E.1, factory planned by Carnegie Models Ltd., 48 Gt. Portland St, W.1.—Marshgate Investment Co., 22 Marshgate La, E.15, plan two factories there.—Toc H (Incorporated), 15 Trinity Sq, E.C.3, plan £100,000 hostel at Church Cres, E.9; architect: F. W. Holder, Gt. Westminster Hse, Horseferry Rd, S.W.1. E.C. Carl Fisher and Associates, 56 Portland Pl, W.1, architects for five-storey Charterhouse Bldgs site building, E.C.1.—Lewis Solomon, Kaye and Ptnrs, Thavies Inn Hse, Holborn Circus, E.C.1, plan nine-storey office block near 35-43 Poultry and 1-6 Old Jewry, etc., E.C.2.—Ley, Colbeck and Ptnrs, Palmerston Hse, Bishopsgate, E.C.2, architects for planned demolition and rebuilding of St. Clement's Hse, Clement's La.—Bernard Gold and Ptnrs, 45 Savile Row, W.1, architect for 19-storey office building at Wood St and the dual carriageway section of London Wall. N.W. Devereux and Davis, 3 Gower St, W.C.1, architects for 16-storey building at Euston Rd, Chilton St, etc., for central hall library, offices, clinic, etc. S.W. S.W. Metropolitan Regional Hospital Board plan extensions to St. Stephen's Hospital. Board's architect: R. F. M. Mellor, 76 Wimpole St, W.1.—Sir Giles Gilbert-Scott, 9 Gray's Inn Sq, W.C.1, architect for £½ million extensions planned for Whitelands Training Centre for Women Teachers, West Hill, S.W.15. W.C. H. V. Ashley and Winton Newman, 3 Verulam Bldgs, Gray's Inn, W.C.1, architects for showrooms and offices, 294 High Holborn, S.E. William J. Harvey, 334 Dollis Hill La, N.W.2, architect for factory, warehouse, etc., at Ormside St, Camberwell, S.E.15.—H. Fitzroy Robinson and Ptnrs, 3 Gray's Inn Sq, W.C.1, architects for 400 ft high office block planned for 80-85 Albert Embankment. W. C. H. Elsom, 10 Lower Grosvenor Pl, S.W.1, architect for shops and offices at 97-99 Baker St, W.1.

Middlesbrough. E.C. scheme for £745,000 extensions to Constantine Technical College. Plans for additions to Easterside Primary and Langbaugh Secondary Schools. Education Architect.

Newcastle T.C. New central library planned for £485,000 at Higham Pl and Saville Pl. Architect.—H. Faulkner Brown, 16 The Grove, Gosforth, architect for St. George's Cres branch library for T.C.—M. of Civil Aviation approves T.C.'s plans for £½ million extensions of Woolsington Airport terminal building.—Waring and Netts, 1 Lansdown Terr, Gosforth, architects for showroom, restaurant, offices and warehouse, Low Friar St, for D. Levey.—St. Andrews Motors Ltd., St. Andrews Bldgs, Gallowgate, plan showrooms/offices, 53 George St. Architects: M. and H. Gatoff, 26 Mosley St.—The Norwich Union Insurance Soc. Ltd., Norwich, plan alterations to 89-91 Jesmond Rd for offices and flat.—Plans for factory extensions at Water St and Penn St for Austin Lifts by Tasker and Ptnrs, 25 New Bridge St.—David Brown, 10 Lambton Rd, Jesmond, architect for R.C. secondary school, Benwell Village.—Plans by Mauchlen, Weightman and

Elphick, 12 Saville Row, for extending residential flats at 105-14 West View.

Newport, I.O.W. Mews Block Co., Trevor Rd, plan factory extensions.—Hooper and Ashby Ltd., Medina Ave, plan warehouses.

Northampton R.D.C. New council chamber and offices, Billing Rd, planned. Surveyor.

Northants T.C. Additional hall and dining room planned at Wollaston Secondary Modern School. Architect, Northampton.

North Riding C.C. Tender: Branch library, Skelton-in-Cleveland. Architect.

Nottingham. Modernisation of General Hospital planned to include new multi-storey block, Sheffield Hospital Board, Old Fulwood Rd, Sheffield.

Notts. National Coal Board plan pithead baths at Hucknall Colliery.

Nuneaton T.C. New £80,158 central library planned. Surveyor.

Oban T.C. Tender: 175 houses on Corran Brae Housing Development, Stage 2. Clerk.

Old Fletton, Hunts. 47 bungalows on private Park Farm estate planned by C. W. Shelton, Stanground, Peterborough.—U.D.C. Tender: 74 houses and garages off Southfields Drive and eight bungalows, Stanground. Surveyor.

Oxford. Hunt and Broadhurst, Botley Rd, plan use of land at rear Ideal Wks for industrial purposes.

Peterborough T.C. Block of flats planned, St. Mary's St slum clearance area. Surveyor.—Five new laboratories, four classrooms, art room, kitchen and dining hall planned by Governors of King's School for 1962.

Portsmouth. Graham Tatford, 1 Milford Rd, Portsmouth, plan warehouse and offices, 136 Kingston Rd.—Portsmouth Trading Co., Old Rd, Cosham, plan breeze block manufactory on 2½-acre site, Fitzherbert Rd, Farlington.—L. Chandler, The Shrubbery, Grove Rd South, Southsea, Hants, architect for warehouse, offices, etc., at Cosham for Collis and Co. (Tobacco) Ltd.

Reading. District Hospital Management Committee plans new £300,000 ophthalmic block next to Royal Berkshire Hospital.

Rochdale. Mellowhide Products, Molesworth St, Rochdale, plan new factory.—Rochdale Observer plans new premises for newspaper production and printing at Drake St.

Scarborough. Moor and Robsons Breweries plan industrial premises on Queen Margaret's Rd site.

Seaham. Durham Coal Board (No. 2 area), Stockton Rd, Sunderland, plans new health centre at Dowdon Colliery.

Sheffield. Stanley Works (Gt. Britain), Rutland Rd, plan new wood and metal finishing departments in Woodside La.

Shepshep U.D.C. 26 houses planned. Surveyor.

Shrewsbury. Brixton Development Co., 22 Eley Pl, E.C.1, plan 17 factories on Harlescott factory estate.

Southall. Tooley and Foster, Midland Bank Chmrs, Queen's Rd, Buckhurst Hill, Essex, architects for £100,000 erection of new admission ward block at St. Bernard's Hospital.—A.E.C. plan £100,000 chassis inspection block, Windmill La.

Southampton B.C. Tender: Contract B356, 95 houses, Thornhill estate; B354, four houses, Glover Rd, Millbrook; B357, 140 flats in seven five-storey blocks, Thornhill estate. Engineer.

Stalybridge. George Crabtree plan works extensions at Shepley St.

Stockton-on-Tees T.C. Tender: Hardwick infants' school. Borough Architect.

Suffolk and Ipswich Fire Authority. Tender: New Colchester Rd fire station. Architects: Johns, Slater and Haward, 32 Foundation St.

Sunderland. Corporation Seaside Developments Committee plans scheme for new hall at Seaburn for exhibitions, etc. Borough Architect, Grange Hse, Stockton Rd.—C. Solomon, 30 St. Mary's Pl, Newcastle, architect for Hadrian Supply Co.'s self-service centre at Northumberland St.—Tenders to

ss Prospects—continued

ted by E.C. for additions to teachers' g college.—E.C. has £45,000 altera- scheme for Sunderland Technical :—S. W. Millburn and Ptnrs, 9 ade, architect for R. Rowley and engine works extensions, St. Mark's liffeld.—G. T. Brown and Son, 14 Terr, Stockton Rd, architects for rn Laundry Ltd. carpet cleaning nent at Back Rossley St.
ma and Cheam. Industrial estate d at rear of Sutton sewage farm.
dom. Tucker and Huntley, 10 Old ton Rd, S.W.7, quantity surveyors for and Hurst factory.
vbridge. McCall Bros., Upper Mills, ew Cradle Bridge mill factory.
ingford. Alan K. Bray, 13 Wensley

Ave, Cottingham Rd, Hull, architect for extension of Associated Maltsters kiln and silos at the Maltings, St. John's Rd.

Wem U.D.C. Tender: Two three-storey blocks of flats, Lowe Hill Rd housing development. Biggins and Assoc., architects, Richmond Hse, 123 Houghton, Chester.

West Kesteven R.D.C. W. Dobie and Sons, Barkston, Grantham, contractors for bungalows at Barkston to cost £8,412.

Weston-super-Mare B.C. Tender: Two factories, one 22,948 sq ft one-storey, with a two-storey front building; the other, 8,042 sq ft of similar construction. Clerk.

Worthing. Worthing Hospital Management Committee plans £130,000 extension to Worthing Hospital, £20,000 extension at Zachary Merton Maternity Hospital, Rustington, and £26,500 at Southland Hospital, Shoreham.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Anatrol. 800,139. Class 9. Apparatus, etc. De Havilland Propellers Ltd., Manor Rd, Hatfield, Herts.

Atmalloy. 803,280. Class 6. Metal alloys, etc. Automatic Telephone and Electric Co. Ltd., Strowger Wks, Liverpool 7.

Blacon. 803,644. Class 9. Conduit and fittings made of plastics. F. C. Blackwell and Co. Ltd., Musker St, Endbutt La, Crosby, Liverpool.

Clade. 796,896. Class 9. Apparatus, etc. Richard Lonsdale-Hands Associates Ltd., Commonwealth Hse, 1-19 New Oxford St, W.C.1.

Decca Debonaire. 802,963. Class 9. Radio receivers, etc. Decca Record Co. Ltd., 9 Albert Embankment, S.E.11.

Iced Diamond. 801,727. Class 11. Refrigerators and refrigerating apparatus. A.E.I.-Hotpoint Ltd., 33 Grosvenor Pl, S.W.1.

Ismay. B775,513. Class 11. Lamps. Ismay Lamps Ltd., Roden St Wks, Ilford.

Lido. 798,124. Class 11. Water heaters, etc. Heatrae Ltd., Heatrae Wks, St. George's St, Norwich.

Permabel. 801,154. Class 11. Heating apparatus for use in hair waving appliances. Perma, 29 bis, rue d'Astorg, Paris, France.

Photocrescents, Attrilux and Altrilux. 804,643/5. Class 11. Lighting installations, etc. Philips Electrical Ltd., Century Hse, Shaftesbury Ave, W.C.2.

Spacelite. 788,017. Class 11. Lamp bulbs. Luxram Electric Ltd., 72 Gt. Eastern St, E.C.2.

Stephone. 805,779. Class 9. Sound transmitting apparatus, etc. Steven and Struthers Ltd., Eastvale Pl, Kelvinhaugh, Glasgow C.3.

NEW COMPANIES

ted from the Register issued by Jordan ons Ltd., 116 Chancery La, W.C.2.

Alexander and Partners Ltd., 52 Brook .l. Electrical, mechanical, electronic, utical, marine, motor, consulting and l engineers, etc. Nom. cap.: £100. Gerald Alexander, Alfred J. Spenser- and John Alexander.

lor Lampshades Ltd., 183a Field End Eastcote, Pinner. Nom. cap.: £100. nent dirs.: George R. S. Cusins and J. Grieve.

Cleasby Ltd., 196 Deansgate, Man-. Electrical engineers, etc. Nom. cap.: . Dirs.: Arthur F. Cleasby, Arthur J. y, Pauline Cleasby and Lucy Cleasby.

V. Collins and Sons (Hassocks) Ltd., 'l, Keymer, Sussex. Electrical engineers ntractors, etc. Nom. cap.: £100. Dirs.: W. Collins, Ethel V. Collins, Peter lins and Joseph M. Collins.

less Hearing Aid Correctors Ltd., 13 orges Rd, Formby, Lancs. Nom. cap.: Dirs.: Robert E. Sheldermine, Sheila ocent, Irene Sheldermine and Roy L. nt.

onic Ltd. Manufacturers of and s in electrical goods, etc. Nom. cap.: Dirs.: to be appointed by subs. Subs.: Noone, 68 Adley St, E.5; and nuel Solomons, 94 Queenborough Ilford.

Jack Ltd., 139 Church Rd, N.W.10. ke over business of a wholesale elec- distributor and radio factor carried Willesden by J. Flack, etc. Nom. £2,000. Permanent dirs.: Jack Flack lrs A. Flack.

S. Gidney Ltd., 72 Watling St, E.C.4. ical equipment specialists, etc. Nom. £100. Dirs.: William A. S. Gidney eorge M. Baron.

C. Ltd., 48 Market Pl, Reading. s in electrical appliances, etc. Nom. £100. Dirs.: George S. Leathwood in de Jong.

A. Kirkby and Co. (Sales) Ltd., 9 n St, Hull. Electrical contractors and ers, etc. Nom. cap.: £5,000. Dirs.: Kirkby and Wilbert A. Kirkby.

roke Electronics Ltd., 96 Dawes Rd, m, S.W.6. Nom. cap.: £100. Dirs.: ick A. M. Jones and Sylvia L. Jones.

l Lamp Co. Ltd. Distributors, mer-, manufacturers of and dealers in able electric table lamps, etc. Nom. £10,000. Dirs.: Jac Jacobsen, Rolf and Jon Brambani. Subs.: John W. an, 50 Whitelands Ave, Chorleywood; Roger W. Lilley, Woodlands, Little rd Way, Shalford, Guildford.

thern Aluminium Co. Ltd. Nom. cap.: Dirs.: to be appointed by subs. Subs.: Clotworthy, "Kemano," East Rd, eorges Hill, Weybridge; and A. A. au, Bush Hse, Aldwyth, W.C.2.

ford Electrics Ltd., 32 Sydney St, on 1. Dealers in washing machines, om. cap.: £1,000. Permanent dirs.: Milford and Raymond Y. F. Horney.

A. Rye and Son (Electrical) Ltd., The Street, Wickhambreau, nr. Canterbury, Kent. To take over business of an electrical contractor carried on at Wickhambreau by A. Rye, etc. Nom. cap.: £1,500. Dirs.: Arthur Rye, David Owen and Sidney R. S. Waghorn.

Basil Spence and Co. Ltd., 6 Surrey St, W.C.2. Manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £2,000. Dirs.: to be appointed by subs. Subs.: Stanley H. Lucas and Francis A. Dean.

Stainforth Electrical and Plumbing Co. Ltd., 13 Silver St, Stainforth. To take over the business carried on by D. J. Humphreys at Finkle St, Stainforth, etc. Nom. cap.: £1,000. Dirs.: Harry Dyson and David J. Humphreys.

Wyman and Archer Ltd. Manufacturers of and dealers in dynamos, motors, etc. Nom. cap.: £1,000. Dirs.: James Wyman and Arthur Geo. Archer. Subs.: Lancelot H. Twaytes and James C. Fenwick, 5-6 Clement's Inn, W.C.2.

Gazette Announcements

BANKRUPTCY ACTS

Receiving Orders

Blackpool. G. Smethurst, electrical dealer, formerly carrying on business at 15 Bowness Ave, Mereside, and at 178 Weston Rd, Blackpool. Receiving order dated 22 Sept.

Cardiff. R. P. Harris, electrician, of 68 Page St, Grangetown. Receiving order dated 22 Sept.

Gloucester. A. C. J. Franklin, electrical engineer, of 142 Southgate St. Receiving order dated 21 Sept.

Blackwood, Tredegar. P. Talbot, radio, television and electrical goods retailer, carrying on business at 100 Bailey St, Brynmawr, Brecon, and at 19 Somerset St, Abertillery. Receiving order dated 26 Sept.

Stafford. Owen and Shaw, electrical contractors, carrying on business at Corner Shop Cross Rds, Hexon. Receiving order dated 23 Sept.

Release of Trustees

Ashton-under-Lyne. D. R. Kemp, electrical contractor, formerly carrying on business as Batty and Jackson, at 15 Farnsworth Ave and North Mill, Katherine St. Trustee: J. Tye, 20 Byrom St, Manchester 3, released as from 13 Sept.

Huddersfield. A. Moore, builder, contractor and electrician, formerly carrying on business at 5 Upper Hirst, Outlane, Huddersfield, and 12 Hay Gate, Mount, Outlane. Trustee: F. L. Kilby, 27 Bradford Rd, Brighouse, Yorks, released as from 5 Aug.

Applications for Discharge

High Court of Justice. G. W. May, electrical contractor, lately carrying on business at 2A First St, Chelsea, S.W.3. Application for discharge to be heard at Bankruptcy

Bldgs, Carey St, W.C.2, on 4 Nov., at 11 a.m.

Swindon. F. Kirk, electrical, radio and calor gas engineer, formerly carrying on business at 11 Railway St, Pocklington. Application for discharge to be heard at County Court Bldgs, Clarence St, Swindon, on 12 Oct., at 11 a.m.

Dividend

Halifax. L. Filby, radio, television and electrical engineer, carrying on business in co-partnership as Filby and Brown at 44 Pa-k St, Brighouse. Dividend per £: 6s 6½d, payable at Official Receiver's Office, 20 North Parade, Bradford 1, on 11 Oct.

COMPANIES ACTS

Norman Electrics Ltd. Creditors to send details to liquidator: K. R. Cork, 19 Eastcheap, E.C.3, by 19 Oct.

Hill's Enterprises Ltd. Meetings of creditors and contributories to be held at Official Receiver's Office, Somerset Hse, 37 Temple St, Birmingham 2, on 7 Oct., at 11 and 11.30 a.m., respectively.

W.E.K. (Electrical) Ltd. Last day for receiving proofs for intended dividend: 15 Oct., to liquidator: J. M. M. Torquil, 4 Bucklersbury, E.C.4.

Capel Electrical and Radio Co. Ltd. Creditors to send details to liquidator: C. R. Watson, 124 High St, Dorking, by 21 Oct.

Sefton Electrics Ltd. Creditors to send details to liquidator: R. P. Booth, 5 Rumford Pl, Liverpool 3, by 1 Nov.

Morbury Electricals Ltd. Liquidator: W. H. Meredith, County Court Bldgs, Westgate St, Cardiff, released as from 6 Sept.

Elizabethan Eng. Co. Ltd. Meeting of creditors to be held at Room 47, Winchester Hse, E.C.2, on 12 Oct. at 12 noon.

MEETINGS TO NOTE

THURSDAY, 6 OCT.

I.E.E. Presidential address, Sir Hamish D. MacLaren, Savoy Pl, W.C.2. 5.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. Presidential address. Social Hall, Hoffman's. 7.30 p.m.

A.S.E.E. (Brighton, Hove and District). "Weather Forecasting," R. G. Vervard. New Imperial Hotel, 1st Ave, Hove. 7.30 p.m.

I.E.S. (Nottingham). Chairman's address. Electricity Centre, Carrington St. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Western). Convention on "Aviation Electronics and its Industrial Applications" until 7 Oct. College of Science and Technology, Ashley Down Rd, Bristol.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scottish). "Technical Education for the Radio and Television Industry," J. B. Rimmer. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N. Western). "V.H.F. FM/AM Transistor Receivers," L. E. Jansson. Reynolds Hall, Manchester College of Science and Technology, Sackville St, Manchester. 7 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). Chairman's address, "Design Processes for Electronic Equipment," H. V. Beck. Cavendish Laboratory. 8 p.m.

I.E.E. (N. Scotland). Centre chairman's address, R. B. Daniel, Dundee.

I.E.S. (Glasgow). "Exterior Lighting for Buildings," L. C. Rettig and H. Baker. British Lighting Council, 29 St. Vincent Pl. 6.30 p.m.

FRIDAY, 7 OCT.

I.E.E. (Medical Electronics Group). Discussion, "Nerve Endings," Savoy Pl, W.C.2. 6 p.m.

I.E.E. (N. Staffs). Chairman's address, G. H. Gillam. N. Staffs Technical College, Stoke-on-Trent. 7 p.m.

A.S.E.E. (Liverpool and District). "A.C. Distribution Equipment for Ships," M. J. Bolton. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

A.S.E.E. (Sheffield). Dinner/dance. Kenwood Hall.

A.S.E.E. (Stoke and Crewe). Annual dinner. Grand Hotel, Hanley.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "The Basic Principles of Digital Instrumentation," D. S. Evans. Admin. Bldg, Esso Refinery. 5.30 p.m.

I.E.S. (Leeds). Chairman's address. British Lighting Council, 24 Aire St. 6.15 p.m.

I.E.E. (N. Scotland). Centre chairman's address, R. B. Daniel. Aberdeen.

MONDAY, 10 OCT.

I.E.E. (E. Anglia). Chairman's address, "Electricity in the Service of Mankind," E. A. Fowler. Cavendish Laboratory, Cambridge. 6.30 p.m.

I.E.E. (N. Eastern). Chairman's address, D. H. Thomas. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands Supply and Utilisation Group). "A Basis for Short-Circuit Ratings for Paper-insulated Cables up to 11 kV," L. Gosland and R. G. Parr. College of Technology, Gosta Green. Birmingham. 6 p.m.

I.E.E. (Western). Chairman's address, A. C. Thirle. Bristol University. 6 p.m.

I.E.E. (N.W. Graduates and Students). Chairman's address, "Patents and Development in Electrical Engineering," D. F. Binns. Engineers' Club, Manchester. 7 p.m.

A.S.E.E. (Bournemouth and District). "Floor-warming Installations," A. Hind. Grand Hotel, Fivale Rd. 8 p.m.

A.S.E.E. (Central London). "Tidal Models and Their Control," Duncan Taylor. White Hall Hotel, Bloomsbury Sq, W.C.1. 7.15 p.m.

A.S.E.E. (N.W. London). "Development of Motor Control Centres," F. Caesar-Gordon. Century Hotel, Wembley. 8.15 p.m.

INSTITUTION OF PLANT ENGINEERS. "Utilisation of Flash Steam," C. R. Crosse. Royal Society of Arts, John Adam St, W.C.2. 7 p.m.

TUESDAY, 11 OCT.

I.E.E. (Measurement and Control Section). Chairman's address, "Time and Insulation," C. G. Garton. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Midlands). "The Application of Transistors to Line Communication Equipment," H. T. Prior, D. J. R. Chapman and A. A. M. Whitehead. H.Q. Mess, School of Signals, Caterick Camp. 6.15 p.m.

I.E.E. (N.W. Utilisation Group). Chairman's address, "Some Effects of Automation," C. Ayres. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Ireland). Chairman's address, "Electricity and the Ulster Farmer," J. McA. Irons. Civil Engineering Department, David Keir Bldg, Queens University, Belfast. 6.30 p.m.

I.E.E. (Scottish Electronics and Measurement Group). Chairman's address, J. Stewart. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (Southern). "The Oral Presentation of Scientific Material," A. Clow. The University, Southampton. 6.30 p.m.

I.E.E. (London Graduates and Students). Chairman's address, "Southern Region, Kent Coast Electrification Scheme—Power Supply Apparatus," A. Porter. Medway College of Technology, Chatham. 7 p.m.

I.E.S. Presidential address, "Lighting and Research," W. S. Stiles. Royal Institution, Albemarle St, W.1. 6 p.m.

A.S.E.E. (Aldershot and Districts). "Electronic Control Apparatus," Dr Fletcher. Queen's Hotel, High St. 8 p.m.

A.S.E.E. (Chester and District). "Electricity Supply Distribution Network," Westminster Hotel, City Rd. 7.45 p.m.

A.S.E.E. (E. Kent). "The Richborough Generating Station," H. W. Le-Grys. County Hotel, Canterbury. 8 p.m.

A.S.E.E. (Glasgow). "Heavy Industrial Control Gear," C. V. Curran. Kenilworth Hotel, Queen St. 8 p.m.

A.S.E.E. (Portsmouth and District). "Industrial Law," Committee Room, Ministry of Labour Offices, Lake Rd. 7.30 p.m.

A.S.E.E. (S. Wales). "The Organisation of Industrial Electrical Maintenance," S. R. A. Phelps. Park Hotel, Park Pl, Cardiff. 7.30 p.m.

A.S.E.E. (York). "Electrical Control of Oil and Gas Burners," D. Stretton-Smith. Royal Station Hotel. 7.30 p.m.

BRITISH INSTITUTE OF MANAGEMENT. Fifteenth National Conference at Harrogate until 13 Oct.

WEDNESDAY, 12 OCT.

I.E.E. (Education Circle). Discussion: "Laboratory Work for the Part III Examination," Savoy Pl, W.C.2. 6 p.m.

I.E.E. (N. Lancs). Chairman's address, C. C. Bacon. N.W.E.B. Demonstration Theatre, Frigate, Preston. 7.15 p.m.

I.E.E. (S. Midlands Graduates and Students). Chairman's address, K. Gunary. James Watt Memorial Institute, Birmingham. 6.30 p.m.

I.E.E. (Rugby). Chairman's address, E. S. Hall. Rugby College of Technology and Arts. 6.30 p.m.

I.E.E. (Oxford). "Some Engineering Problems on Nimrod," P. Bowles. District Offices, Southern Electricity Board, 37 George St, Oxford. 7 p.m.

A.S.E.E. (Birmingham). "The Provisions of Adequate Electrical Installations in Buildings—Small Industrial Premises," J. A. Sharp. Exchange and Engineering Centre, Birmingham 2. 7.30 p.m.

A.S.E.E. (Leicester). Haldane Regional Lecture: "Electricity from Water Power and Pumped Storage," M. Braikевич. Edward Wood Hall, London Rd. 7.30 p.m.

A.S.E.E. (Luton). "Panel Floor-warming and Ancillary Equipment," D. W. Ackery. Luton College of Technology, Park Sq. 8.15 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (W. Midlands). "Electrical Synthesis of Music," Alan Douglas. College of Technology, Wolverhampton. 7.15 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "Electro-Acoustics for Human Listeners," Professor Colin Cherry. London School of Hygiene and Tropical Medicine, Keppel St, Gower St, W.C.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Manchester). "Data Handling and Processing," E. K. Robertson. College of Science and Technology, Sackville St. 6.45 p.m.

WOMEN'S ENGINEERING SOCIETY. "The Use of Microwaves in Telecommunications," J. Rice. Hope Hse, 45 Gt. Peter St, S.W.1. 7 p.m.

THURSDAY, 13 OCT.

I.E.E. (Utilisation Section). Chairman's address, "Developments in Electrical Plant for Industry," J. M. Ferguson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Southern). "The Measurement of Time," L. Essen. S. Dorset Technical College, Weymouth. 6.30 p.m.

I.E.E. (West Wales). Chairman's address, J. Nelsey. Conference Room, S. Wales Electricity Board, Kingsway, Swansea. 6 p.m.

I.E.E. (Southern Graduates and Students). Chairman's address, "A Review of Modern Computing Elements," R. E. Hayes. The University, Southampton. 6.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (S. Western). "Introduction to Milwaukee-Matic," A. Tack. Technical College, Brunswick Rd, Gloucester. 7.30 p.m.

COUNCIL FOR PRESERVATION OF RURAL ENGLAND. National Conference for Preservation of the Countryside at Weymouth until 15 Oct.

FIRST ELECTRICAL ENGINEERS' EXHIBITION DINNER. Grosvenor Hse, London.

A.S.E.E. (Bradford and District). "Further Discussion on the I.E.E. Regulations," J. L. Browell and H. F. Smith. Midland Hotel. 7.30 p.m.

A.S.E.E. (S.W. London). "Recent Developments in Luminescent Light Sources," Thorn Hse, Upper St. Martin's Ln, W.C.2. 8 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Teesside). "The Errors of Instruments—Their Study and Importance," H. Kenney. Cleveland Scientific and Technical Institute, Corporation Rd, Middlesbrough. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). "Any Questions," M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Control Section). "Transistor Switches in Monitor and Control Systems," W. A. Ross. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

I.E.S. (Manchester). "Lighting Journey Down the Rhine," E. J. Smith. Demonstration Theatre of N.W.E.B., Town Hall Extension, Manchester 2. 6 p.m.

HACKBRIDGE HOLDINGS LTD.

Expanding Demand Envisaged

THE 12th Annual General Meeting of Hackbridge Holdings Limited was held on 30 Sept. in London, Mr A. L. Foulger (the Chairman) presiding.

The following is a summary of his circulated statement:

In my last report I emphasised the severe competition in the Home and Export Markets for business with greatly reduced profit margins. Many references have been made elsewhere to this state of affairs and in particular the intense price cutting in the Cable Industry, and as production costs have tended to rise this had a further adverse effect on final results, which fortunately our Organisation is sufficiently diverse to minimise.

Our Group subsidiaries, which have excellent management teams, were able to secure a reasonable share of business during the year ended 31 March, 1960, resulting in a trading profit of £276,777. After providing £116,141 for depreciation and £102,623 for taxation, and crediting post-acquisition profits of a newly-acquired subsidiary of £24,363 there remains the sum of £82,376 available net profit. After payment of net dividends on the Preference and Ordinary Share

Capital the sum of £13,470 has been retained by the Group. Consequent upon the revaluation of Fixed Assets and the purchase of subsidiaries, consolidated capital revenue reserves now amount to £1,653,182.

During the year under review we incurred capital expenditure of £70,978 with further commitments of £6,001 outstanding. Your Directors consider there is every reason to expect an expanding demand for our products and that substantial capital expenditure will therefore be justified.

Generally, business is brisk at the present time and our Group order book is substantial. If the demand continues and reasonable profit margins can be achieved, I am confident that we shall obtain reasonably good result again this year.

The report was adopted and the final dividend of 12½% making 20% for the year was approved.

A proposal to increase the authorised capital to £1,700,000 by the creation of a further 3,200,000 Ordinary Shares of 5s each was duly sanctioned.



B.E.R.L.
for
A.C.
and
D.C.
repairs

The illustration shows the soldering winding to commutator risers of a 50 kW., D.C. generator armature.

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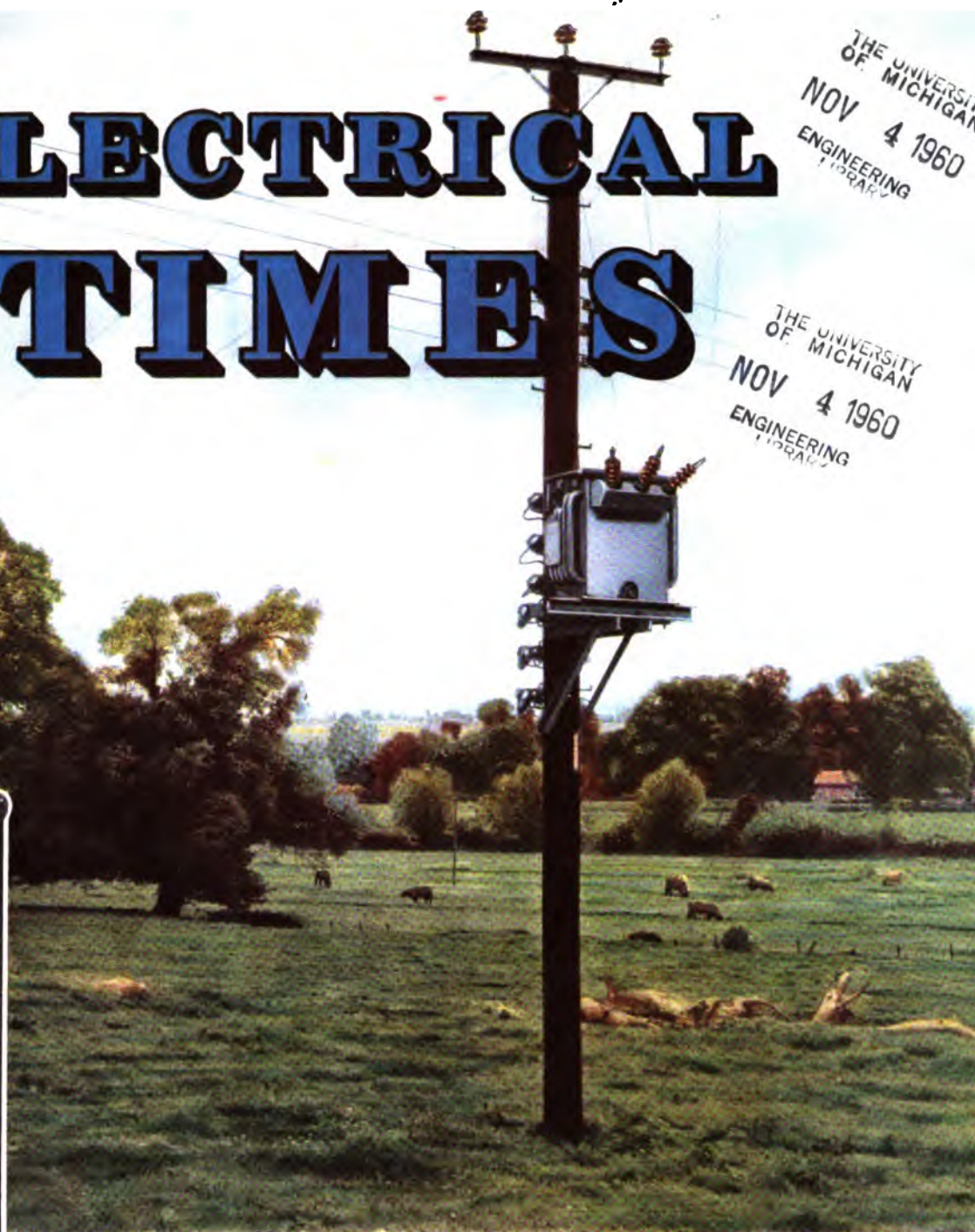
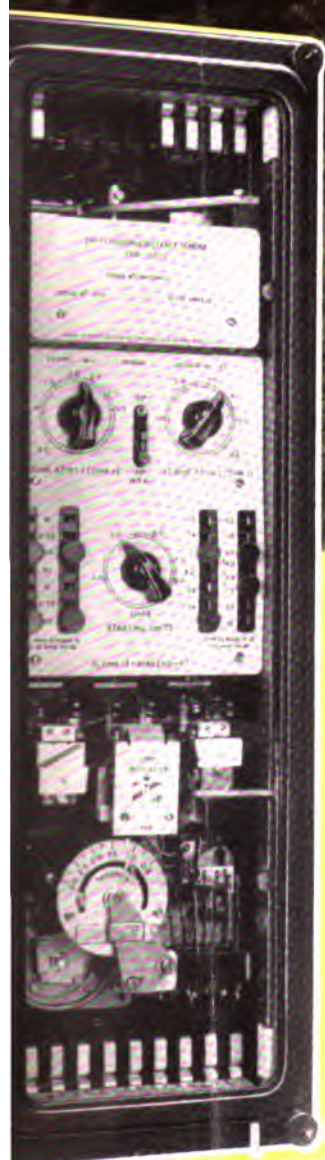
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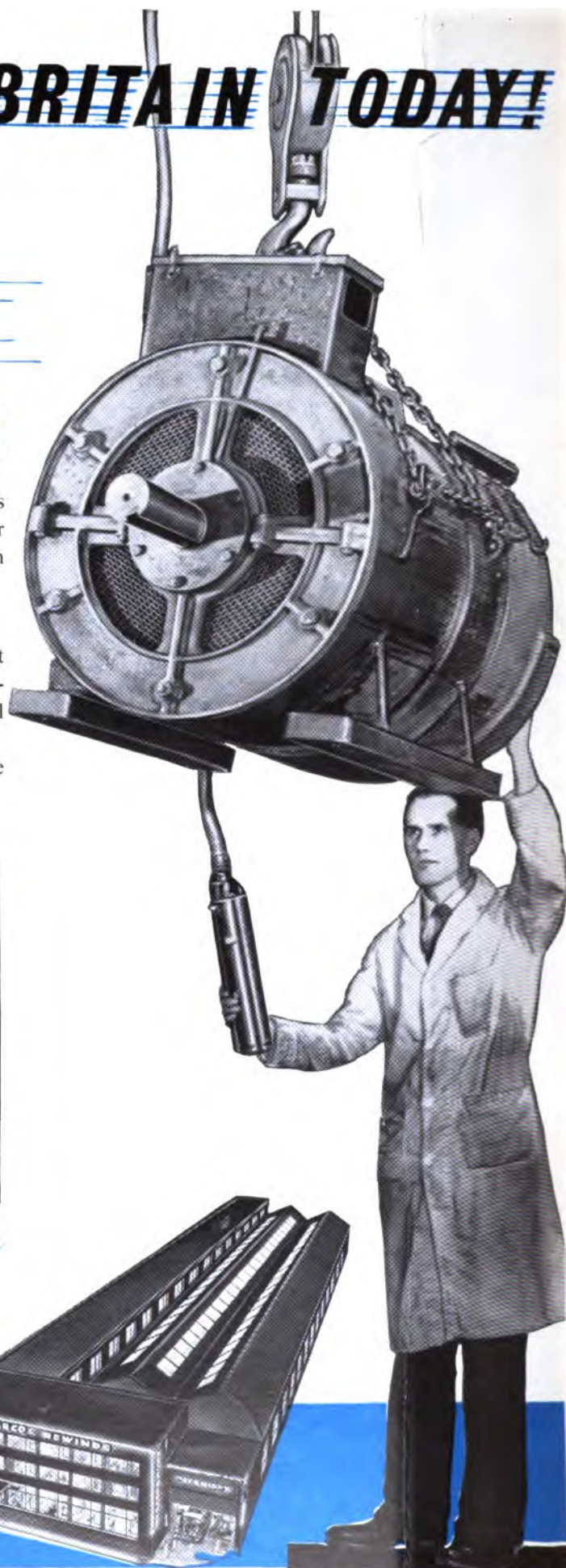
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Lingots d'aluminium jusqu'à une épaisseur de 41 cm. et une longueur de 380 cm. peuvent être laminés dans un laminoire à chaud reversible de nouvelle construction. Ce laminoire est commandé par deux moteurs de 4.000 h.p. chacun à courant continu dérivé d'un groupe Ilgner. Les moteurs sont disposés de façon que le supérieur est plus près au laminoire pour permettre l'accès également facile des deux moteurs. Les moteurs principaux, le groupe Ilgner et les autres commandes and contrôles sont placés dans la chambre des moteurs adjointe au laminoire.

Moteurs électriques pour les Chemins de Fer Britanniques ... 556

Locomotives électriques et matériel roulant à unité multiple ont été le sujet de discussions à une conférence internationale. Les locomotives du système 25/6.25 kV à 50 Hz sont fournies d'un moteur à courant continu muni d'unités transformateur/redresseur et sont destinées à atteindre une vitesse de 160 km. par heure avec un charge trainé de 475 tonnes sur chemin horizontal. Unités multiples pour le service de banlieue sont destinées à atteindre une vitesse de 120 Km. par heure avec une accélération moyenne au départ de 1,76 Km/h par seconde.

Centrale Ecoisaise de 760 MW ... 565

La Centrale de Kincardine est située sur le Firth of Forth dans l'Ecosse meridionale. La première phase comprends trois turbo-alternateurs alimentés à vapeur à chaudière individuelle pour 390 tonnes par heure. Les caractéristiques de la vapeur prises à la soupape d'arrêt de la turbine sont 105 Kg/cm² à 538°C. avec un rechauffement jusqu'à 538°C après passage à travers le cylindre de haute pression. On a déjà commencé l'addition de deux groupes de 200 MW chacun à cette centrale.

In dieser Nummer

Aluminium-Umkehrwalzwerk ... 547

Auf einem vor Kurzem in Dienst gestellten Umkehr Heisswalzwerk können Aluminiumbarren bis zu 410 mm stark und 3800 mm lang ausgewalzt werden. Der Antrieb erfolgt durch zwei nach dem Ilgner-System gespeisten Gleichstrommotoren von je 4000 PS, die so angeordnet sind, dass der höher gelegene Motor der Walzstrasse am nächsten liegt. Hierdurch wird erreicht, dass beide Motore gleich gut zugänglich sind. Die Antriebsmotore, der Ilgner-Satz und sämtliche übrigen Antriebs- und Steuerungsorgane sind in einem neben der Walzhalle gelegenen Betriebsraum untergebracht.

Elektromotore für die britischen Eisenbahnen ... 556

Auf einer internationalen Konferenz standen elektrische Lokomotive und Triebwagenzüge zur Diskussion. Die für das britische 25/6,25 kV, 50 Per.-Netz vorgesehenen Lokomotiven haben durch Umformer gespeiste Gleichstrommotoren und sind für eine Höchstfahrgeschwindigkeit von 160 km/St bei einer Zuglast von 475 Tonnen auf ebener Strecke ausgelegt. Für den Vororteverkehr bestimmte Triebwagenzüge sind für eine Höchstfahrgeschwindigkeit von 120 km/St und eine mittlere Anfahrbeschleunigung von 1,76 km/St/sek konstruiert.

760 MW-Kraftwerk in Schottland ... 565

Das neue Kincardine-Kraftwerk liegt an der Forth-Einbuchtung im südlichen Teil Schottlands. Die erste Entwicklungsstufe umfasst drei 120 MW-Turbogeneratorsätze, deren Dampfverbrauch Einheitskessels mit einer Nennleistung von 390 t/h entnommen wird. Dampfverte am Turbinenabsperrventil: 105 kg/cm², 538° C mit Wiedererhitzung auf 538° C nach der Hochdruckstufe. Der Einbau zweier weiterer 200 MW-Generatorsätze wurde bereits in Angriff genommen.

D

ELECTRICAL TIMES

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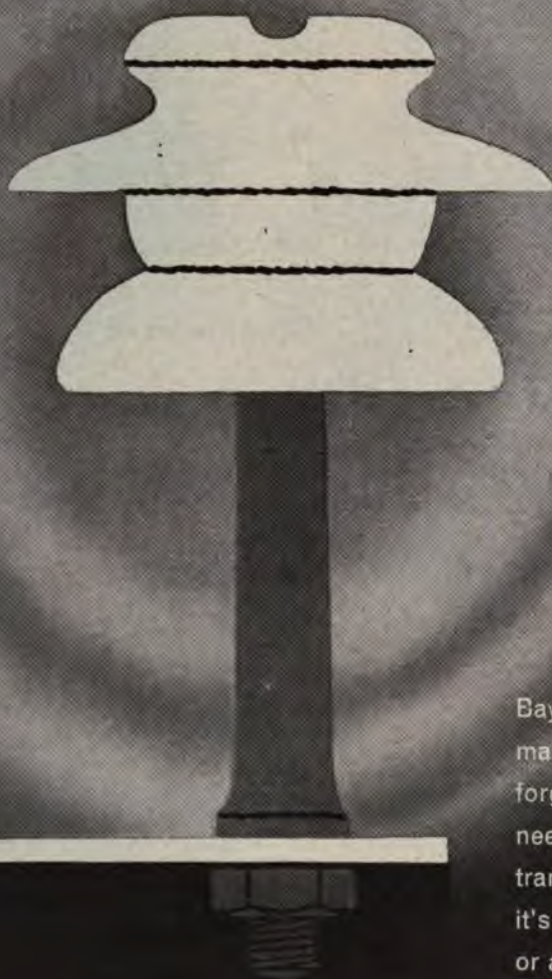
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Comment

FINANCE FOR SUPPLY

There is a welcome confidence and pride in the strength of the supply industry in an important review of the industry's financing practice which Dr R. S. Edwards, one of the Electricity Council deputy chairmen, has contributed to *Lloyds Bank Review*. He expresses a fear that his article may be read as either defensive or complacent, but there is little defensive in his claim that: "If the electricity industry was told to fend for itself and given freedom to choose how best to do this it could make a good showing on the capital market... In the financial framework within which it is asked to live it pays its way. It could do so in any other." Nor is there complacency in his discussion of tariff design as a means to an improved load factor, where he shows concern that enthusiasm for lower unit charges could lead to the position where increasing volume of business resulted in lower rather than higher surpluses because charges fall below marginal costs. This survey is going to be quoted as an important inside opinion on the case for present practice in the industry; practice which is conveniently considered as applying overall, but which must in the last resort be related, as Dr Edwards is careful to emphasise, to the individual responsibility of each board separately for its financial results. Inevitably, it is in large part a repetition of the financial section of the recently published Electricity Council report, but the additions are significant. Outstanding amongst them is an indirect contrasting of the abilities of the area boards and of the Generating Board to meet unexpected demands. For the Generating Board, as we pointed out last week, the older plant on the system provides a margin either way. It could be kept in being to meet occasional peaks if there was underestimate, or taken out of service without serious financial consequences if demand fell below long-term expectations. But the distribution networks have been starved of capital too long. They have no "fat" to eat up when underestimate occurs. Fast injection of capital is their only hope of survival, a situation which seems only recently to have been admitted at Government level.

PAYING FOR THE FARMER

There is welcome imagination and enterprise in the Eastern EB announcement last week-end that they are to embark on a planned scheme to complete rural electrification in the area over the next five years. Some 5,000 farms and nearly five times that number of other rural premises are involved, inevitably the most remote in an area which has the second highest number of farms of all the area

boards. To connect them with reasonable economy will need careful planning and large-scale operation of line gangs; it will need as well the co-operation of the populace, individually and through local authorities, so that the growing delay over wayleaves and planning permission, respectively, can be kept to manageable proportions. Yet even if all this is obtained, and the vigour of the Eastern Board approach promises well on that point, "Operation Round-Up" will only go through by courtesy of existing EEB consumers. This is because the Board intends to keep connection charges unaltered, although they are based on calculations in relation to more accessible premises. Such charges cannot cover the economic cost of the new schemes, however onerous the potential consumers may find them. Of course, the Board is well within its rights in its decision. It has to "secure so far as practicable" extension of supplies to rural areas, just as it has to "secure so far as practicable" cheapening of supplies generally, and ensure that its revenue account is not in deficit. The Eastern EB have decided that its inlying consumers shall help those more remote. A question which must arise is how this policy will affect the hope of some other boards to persuade central government that any such subsidy should be its responsibility, not that of the supply industry.

ELECTRIC BLANKET ACCIDENTS

Consumers Association Ltd., in their publication *Which?*, this month tackle the question of electric blankets, not from the aspects of value for money or operating efficiency, but from the safety angle. Electric blankets are a great comfort, but their safety record has not been so good as that of most electrical devices. It has been improving—the 2,600 fires in 1956 quoted by *Which?* is probably reduced to about a quarter now, despite many more blankets in use—but there are more accidents, including fatalities, than can be regarded with equanimity. *Which?* puts emphasis on loading and thermostatic control in its discussion of blanket safety, but it may be that although neglect of such factors leads to burns it is other causes that are more responsible for serious trouble. For example, one leading authority has suggested that open-circuit arcing is the main cause of fires originating in electric blankets. That underlines one of the alarming characteristics of electric blankets; it is easy to make a blanket of some sort at a low price, probably expensive to ensure that the blanket that looks the same and heats the same remains safe under the stress of constant use.

TARIFF ACROSS THE BORDER

With electricity tariffs at the moment so much in the mind of area boards, it is worth while giving close attention to what is happening across the border. The South of Scotland EB, which had an origin common with that of other area boards, now has the distinction of looking after its own generation and freedom from the mutual influence of Sir

Robertson's round table. Such independence has obviously played a part in the second round of tariff changes that the Board are now making following the 6% rise in domestic and commercial tariffs earlier this year. The particular success that they have had in off-peak load development has whetted their appetite for more. With about one-fifth of the off-peak load of Great Britain within their area, they are now cutting tariffs by 0.04/0.05d a unit, while retaining the favourable basis of restricted periods. Of greater effect is the rise of three shillings a kW m.d. for industry, reflecting the higher capital charges of modern plant, a factor to which the CEEGB has already given tariff-wise expression. There is also some corresponding reduction in the unit charge. The distinguishing feature of this new tariff lies in the coal adjustment clause. This is now based on a cost of 90s a ton instead of the familiar 60s so that, with average coal cost below this figure, the consumer will be given a rebate on a higher-priced unit instead of the usual surcharge on a lower-priced one. The psychological niceties of the two charging methods will no doubt lead to endless discussion between tariff specialists, particularly as the South Scotland adjustment is 0.00004d (0.00002d h.v.) lower than most tariffs south of the border, possibly due to the higher component of hydro-electricity purchased and generated.

WHY THE NAVY WENT A.C.

Electrical equipment accounts for almost one-third of the cost of new ships for the Royal Navy. That startling estimate by the incoming president of the IEE, Sir Hamish MacLaren, indicates the importance of the tale he tells in his presidential address of electricity's rise afloat. A crucial decision that stands out is the choice of alternating current for post-war construction; and the selection of the American 60 c/s standard for frequency. At this late time, Sir Hamish's rehearsal of the arguments for this choice remains of interest. Increasing power demands made a higher voltage necessary and the higher voltage was a strong indication for a change to a.c. despite real and imagined difficulties about variable speed drives. Close behind electrical necessity came general weight considerations, and here the distribution economy of a multi-phase system had added attraction. But what frequency? From the weight aspect, the highest possible; 60 c/s was the final choice, ostensibly because it gave something in weight advantage while at the same time keeping within the well established design range. Of course, it also gave compatibility with the US Navy, though Sir Hamish suggests that as an incidental factor. That choice, however, has proved decisive for the merchant navy as well, and some of the consequential RN decisions, such as the choice of a high standard of automatic voltage regulation at generators rather than use of voltage stabilisation gear in equipment have also been instituted.

Meteor

Hot reversing mill for aluminium—part 1

by G. H. Sutton*

THE plant installed at the Rogerstone Works of Alcan Industries Ltd., formerly Northern Aluminium Co. Ltd., in 1950 for the production of aluminium sheets appeared in 1956 to be approaching the production limits, both for size of product and for quantity of production. The layout of this hot mill line is shown in Fig. 2. Use of large aluminium plates for ship superstructures had increased and showed every prospect of further expansion. Alcan Industries, therefore, decided that the capacity of the hot strip line should be increased and a breaking-down stand installed which would be capable of rolling large plates from ingots of up to 16 in. thick, 150 in. long and weighing 17,500 lb.

In July, 1957, AEI were authorised to proceed with the design work and later with manufacture. The developments which were finally decided upon were as follows:

1. A four-high hot roughing reversing mill would be installed in front of the existing hot line and used for the initial breaking down before the slabs are conveyed

into the existing breaking-down stand (96 in. mill). The 144 in. hot reversing mill was to be of sufficient width and power to enable it to function as a plate mill independently of the hot line.

2. The existing breaking-down stand (96 in. mill) would become the intermediate stand and the existing intermediate stand (84 in. mill) would be removed and replaced by transfer tables.

The existing finishing mill comprising two four-high stands in tandem would be increased to three stands with provision for the later installation of a fourth stand. Initially, there would be a single hot coiler synchronised with the final finishing stand. Provision was to be made for installing a second coiler at a later stage. The new arrangement of the hot line is shown in Fig. 3.

Hot Reversing Mill

The electrical equipment supplied for the 144 in. hot reversing mill was designed to drive and control all operations on the ingot from leaving the ingot heating furnace, through the rolling schedules, until it is cut to

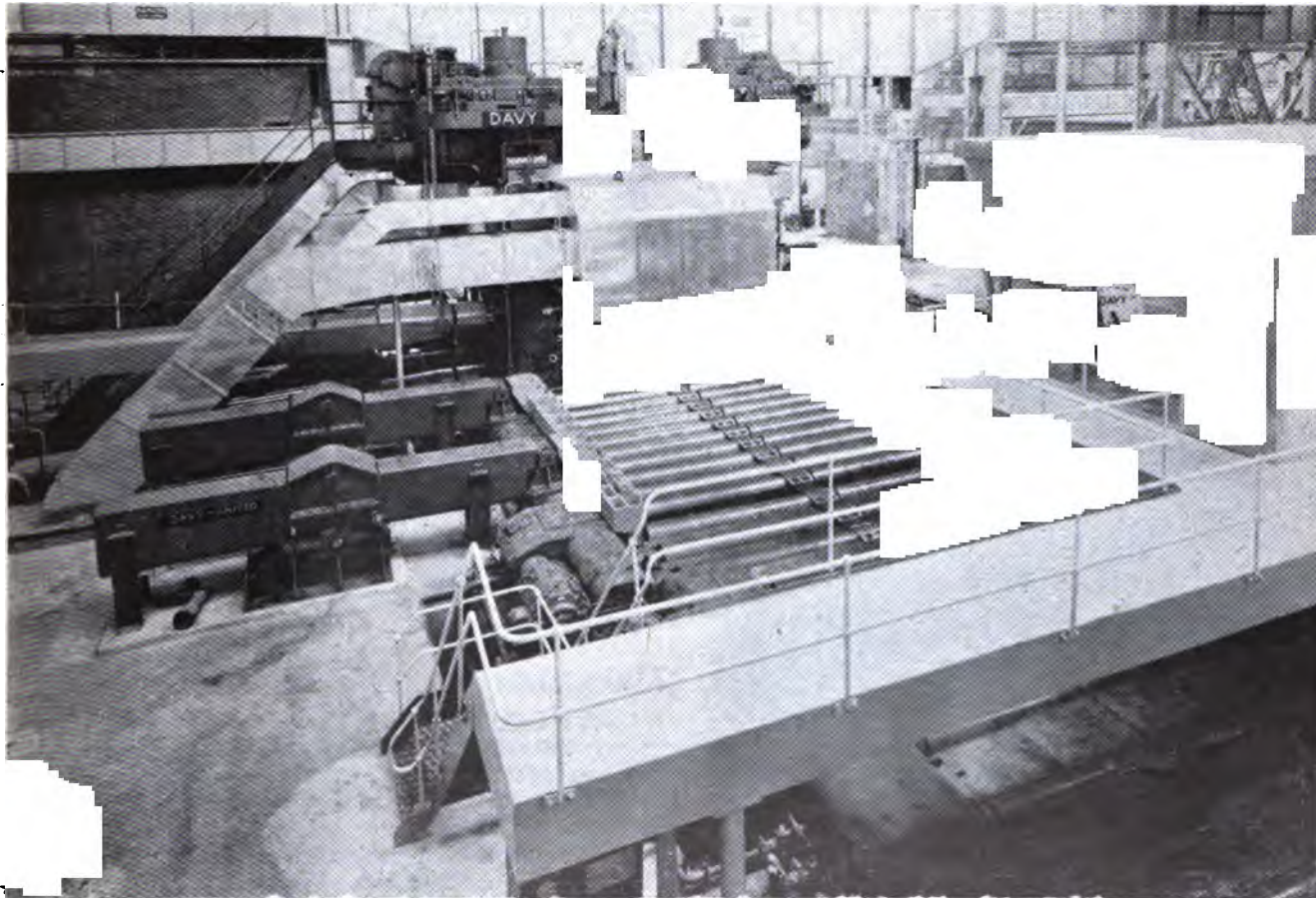


Fig. 1. General view of 144 in. hot reversing mill at Rogerstone Works of Alcan Industries Ltd.

Fig. 2. Layout of hot mill line installed in 1950

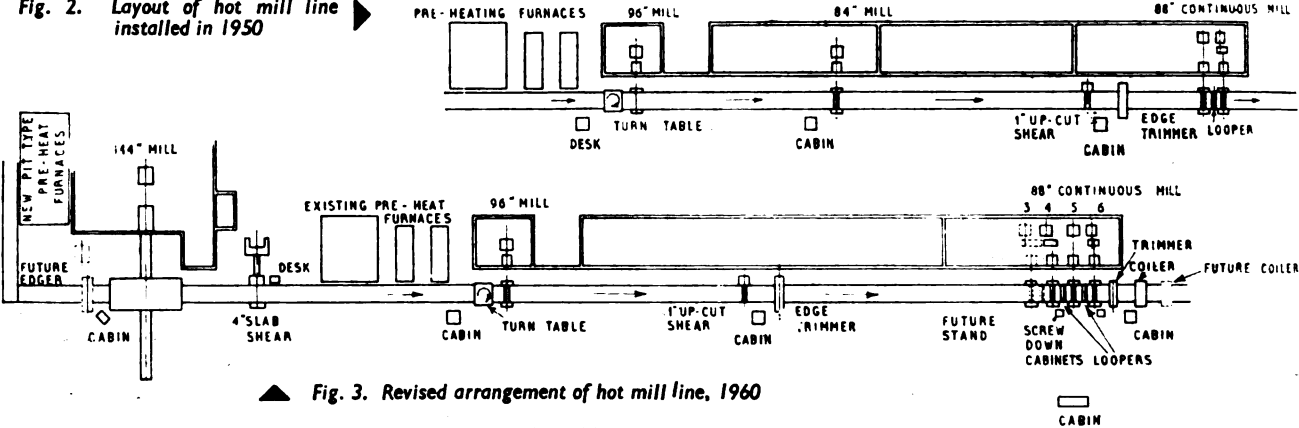


Fig. 3. Revised arrangement of hot mill line, 1960

Table 1. Main drives for hot reversing mill

Drive		Continuous Rating h.p. or kW.	Peak Rating h.p. or kW.	Cut-out Rating h.p. or kW.	R.P.M.	Volts
Mill motors (twin drive) ...	2	4,000	10,000	12,000	30/60	950
Ilgnr set: induction motor ...	1	8,000	16,000	18,400	750	11,000
flywheel ...	1	200,000				
generators ...	4	1,600	4,000	4,800	750	475
Main exciter set synch. motor...	1	1,000	0.5	1,000	1,000	11,000
Slab shear motors ...	2	400	leading p.f.	1,200	650	400
Slab shear set synch. motor ...	1	1,000	0.5	1,000	1,000	11,000
Screwdown motors ...	2	200/400			0/420/840	0/230/460
Table motors ...	11	75/150	leading p.f.		0/515/1030	0/230/460

the required length in the slab shear. It is then either passed on to the 96 in. mill for further rolling and coiling or is removed as a completed plate.

The main drives are listed in Table 1, above.

Layout

The space available for the electrical equipment was limited but it was possible to place the motor room between the 96 in. mill pre-heat furnaces and new pit-type pre-heat furnaces. This arrangement was also convenient because a single additional bay could be built to house the mill, roll grinding shop and motor room served by a common 125 ton/25 ton crane. The crane passes through an opening fitted with roller shutter doors between the motor room and the mill.

The position of the motor room has made it much squarer than usual. The layout is shown in Fig. 5.



Fig. 4. Pulpit control desk for hot reversing mill

By placing the Ilgnr set parallel to and adjacent to the mill motors, the aluminium busbar runs are reduced to a minimum. The lubrication room is at the non-drive end of the mill motors, where it is in a convenient position to obtain adequate fall from all bearings. This layout has the advantage that the busbars and the oil pipes do not cross, since the oil pipes are taken from the outer sides of both blocks. A heavy erection area with a strengthened floor is provided

over the lubrication room, capable of taking the weight of a motor armature and two frames (about 220 tons). The two main auxiliary motor generator sets are placed between the Ilgnr set and the mill motors, as they stand on a suspended floor of the motor room and do not require any foundations extending into the basement.

On the opposite side of the Ilgnr set from the mill motors are the converters for supplying the table motors. These consist of six pumpless steel tank truck-mounted converter units with two grid control cubicles.

Adjacent to the converters are the dynamic braking switches for the Ilgnr set motor.

All control gear is mounted in an annexe (Fig. 8) which is sound-proofed and separated from the motor room by double glazed screens. A total of 176 ft of open control panel is provided. The d.c. control panels are mounted on the ground floor while the a.c. control panels and distribution switchgear are mounted immediately above on a gallery. The supervisory desk is set against one of the glazed screens so that the operator looks out onto the motor room and has his back to the control panels.

In between the control panels and the supervisory desk are the magnestat cubicles housing the magnestats (magnetic amplifiers) and amplifiers for: feed rolls; turntables; load balance; screwdowns; slab shear. Also housed here are phase shifting auxiliaries and reversing switch static switching for the table drives.

The alarm annunciation equipment is mounted beside the magnestats.

Mill Motors

Until recently, large twin drives have been built with the top roll motor further from the mill than the other, a jackshaft passing over the bottom roll motor to a bearing on a bridge or "A" frame which spans the drive-end bearing of the bottom motor. With this arrangement access to the bottom roll motor is difficult and for any major inspection the jackshaft must be removed before the motor frame can be lifted.

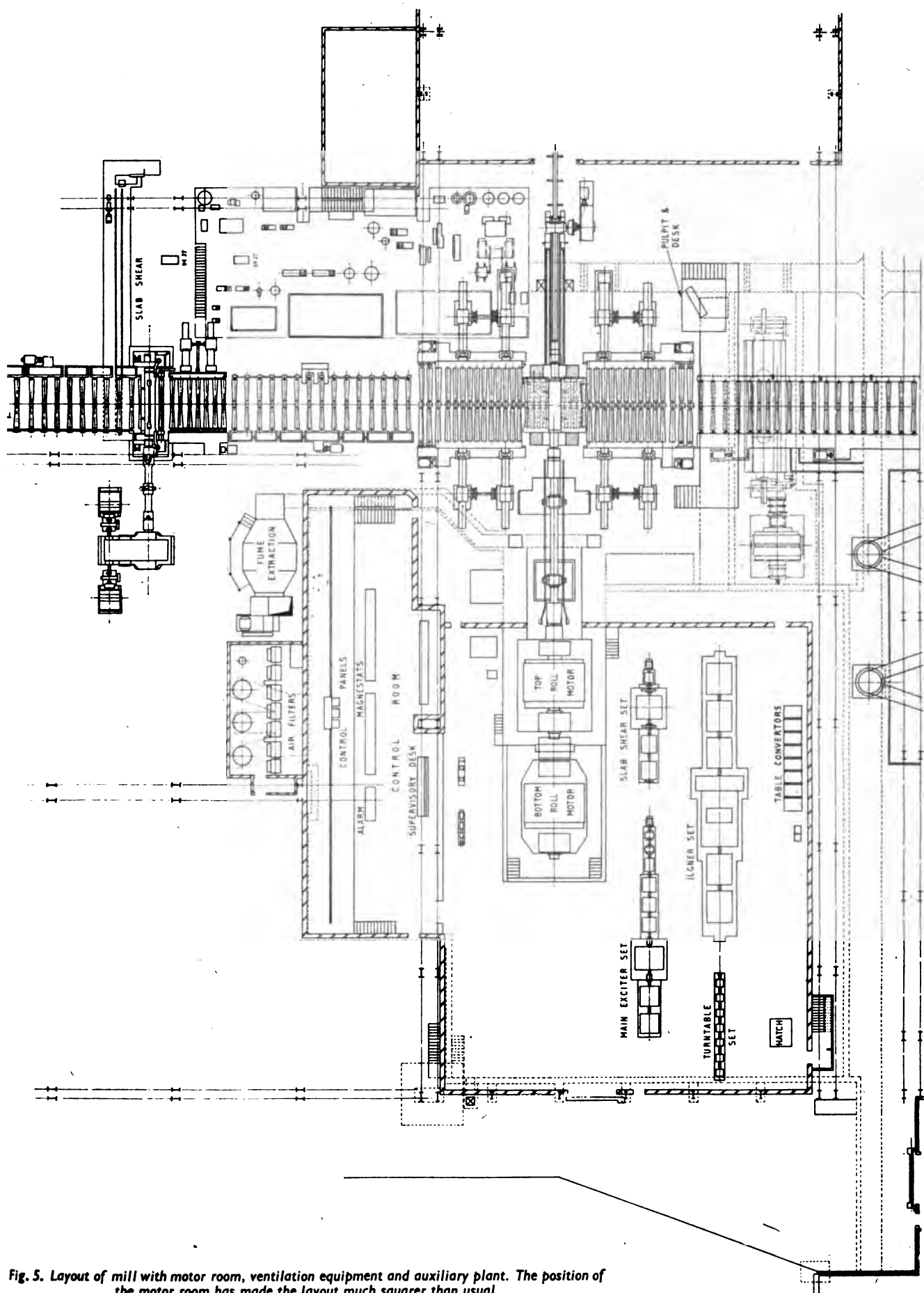


Fig. 5. Layout of mill with motor room, ventilation equipment and auxiliary plant. The position of the motor room has made the layout much squarer than usual

In order to provide equally good access to both motors, twin drives may be arranged with the top motor nearer the mill and the bottom roll drive passing underneath it, so that the jackshaft, which needs no maintenance and is never likely to need replacement, is out of sight and out of the way. This has been referred to as the "top forward" arrangement and a number of such drives are in operation in America.

The hot reversing mill motors form not only one of the highest-torque twin drives but also the first "top forward" twin drive in this country.

The arrangement of the two motors is shown in Figs. 9 and 10.

The top motor drive end bearing and the jackshaft bearing are mounted, respectively, above and below a stiff beam which forms a tie between the two sides of the baseplate. The baseplate is sectionalised to permit the jackshaft to be removed should this ever be necessary. The underslung jackshaft bearing can be serviced readily from beneath as there is plenty of clearance downwards. The weight of the jackshaft is taken on a built-in hydraulic jack and the bearing can then be dismantled, Fig. 9. A special built-in tackle is used to lower, first the sump (after draining), then the bearing liner retaining cap and finally the bottom and top half liners (the top half liner can be slewed round into position for lowering). The parts are lowered onto a trolley which can be run out through a passage in the foundations onto a platform in the basement directly under a hatch in the motor room floor. When the hatch cover is removed the parts of the bearing can be lifted by the motor room crane.

The five bearings of the motors and jackshaft have identical and interchangeable white metal journal bearings suitable for continuous high pressure lubrication and equipped with standby disc and scraper assemblies. The two commutator end (non-drive end) bearings also incorporate a double ring reversible flood-lubricated Michell thrust bearing operating against a collar which is part of the shaft forging. These bearings have a thrust capacity of 104 tons continuously and 315 tons momentarily. The thrust is transmitted directly to the pedestals and does not pass through the journal liners.

Since the thrust is taken at the non-drive end, the front support beam is relieved of this duty and the forces are taken to the point where the foundation block is best able to receive them. The thrust is taken between the bearing housing and the baseplate by transverse folding keys. Vertical thrust posts are cast into the foundation block and project into recesses in the baseplate. Jacking screws in the baseplate perform the double function of facilitating the initial lining up and, when the installation is complete, clamping the baseplate to the thrust posts. Thus the transmission of thrust does not depend solely upon the tightness of foundation bolts or the quality of the grouting.

The couplings between the jackshaft and the bottom motor are flanged couplings with taper sleeves for oil injection mounting. The two flanges of the coupling are bolted together by accurately pre-tensioned bolts in clearance holes. The torque is transmitted by means of radial dowels drilled into the coupling joint.

A tacho-generator is mounted on the non-drive end shaft extension of each motor. The outputs of these tachos are used for speed indication of the two motors and also to provide signals for feed roll motor control.

Each motor is supplied from two generators on the Ilgner set through a high-speed circuit-breaker and a hand-operated isolator which are mounted in the basement. The two generators for each motor are connected in series so that in an emergency either generator can be shorted out, and the mill run with reduced throughput.

Mill Motor Control

The mill motor control scheme provides the following facilities:

1. Unified control of the mill from a lever-operated controller.
2. Forcing of motor and generator fields to give rapid acceleration and retardation.
3. Automatic limitation of the degree of generator field forcing on heavy passes.
4. Automatic prevention of excessive field weakening if the control lever is moved right over on a heavy pass.
5. Automatic limitation of regenerative current if the control lever is moved quickly to the off or reverse position.
6. Protection which can be reset by the operator against excessive loads due to incorrect drafting, cold metal, etc.
7. Fault protection.
8. Prevention of creeping or provision of a low creep speed as required.
9. Hand adjustment of relative speed to take care of main roll diameters, drafting, etc.
10. Automatic balancing of load on the top and bottom roll motors.
11. Hand adjustment of the relative loads at which automatic balancing operates.

Ilgner Set

The Ilgner set consists of four generators, a flywheel, an induction motor and a tacho-generator solidly coupled together.

The arrangement of the set (Fig. 7) is:

- Tacho-generator.
- Two mill generators.
- Motor.
- Flywheel.
- Two mill generators.

A third generator can be mounted at this end of the set to supply an edger motor if this is found to be necessary.

The 12 ft diameter, 28 ton flywheel has two bolted stub shafts and is carried in two Michell tilting pad journal bearings. A cradle is slung underneath and suspended from the baseplate by four long bolts. The flywheel can be lifted quickly with this cradle so that the bearing pads can be changed.

The induction motor and generators all have journal bearings with standby oil rings.

Ilgner Set Induction Motor Control

The induction motor is controlled by a liquid slip regulator. Closing the oil circuit-breaker initiates an automatic starting sequence, the pilot motor on the liquid slip regulator lifting the counter-weight to lower the electrodes so that the rotor circuit resistance is steadily reduced until the induction motor is up to speed. Slip regulation under load is controlled automatically by a magnestat.

For quick stopping of the set, dynamic braking is applied to the induction motor. Direct current is supplied to the motor stator from the main generator exciter, the energy of the set being dissipated in the slip regulator. The d.c. dynamic braking current is controlled by contactors on the main control panel. The line and braking supply isolating switches are electrically and mechanically interlocked.

Slab Shear

The slab shear is driven by two d.c. motors each driving opposite ends of a pinion shaft in the shear gearbox. The motors are supplied from two generators on the shear

Fig. 6. Main motors for the hot reversing mill. The motors are arranged as a "top forward" twin drive, the first in the UK. Each is rated at 4,000 h.p., 30/60 r.p.m., and both are supplied from a single Ward-Leonard-Ilgner set. Details of the motor layout are shown in Fig. 10. The control room for the motors is seen in the background (left)

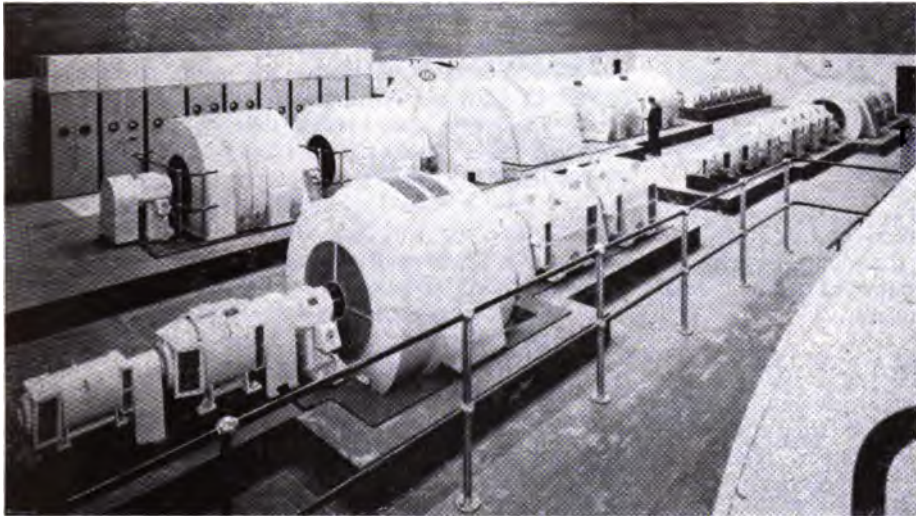
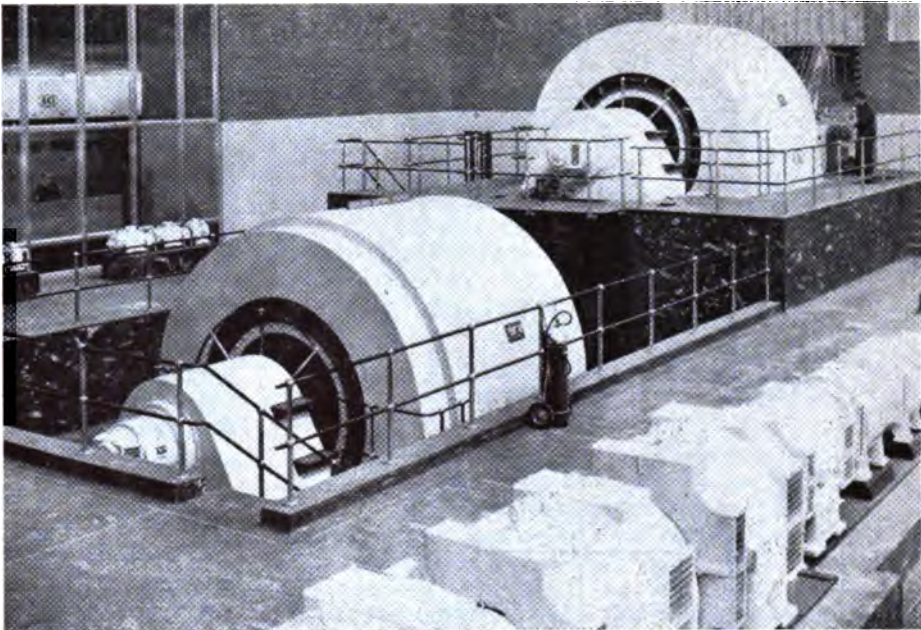
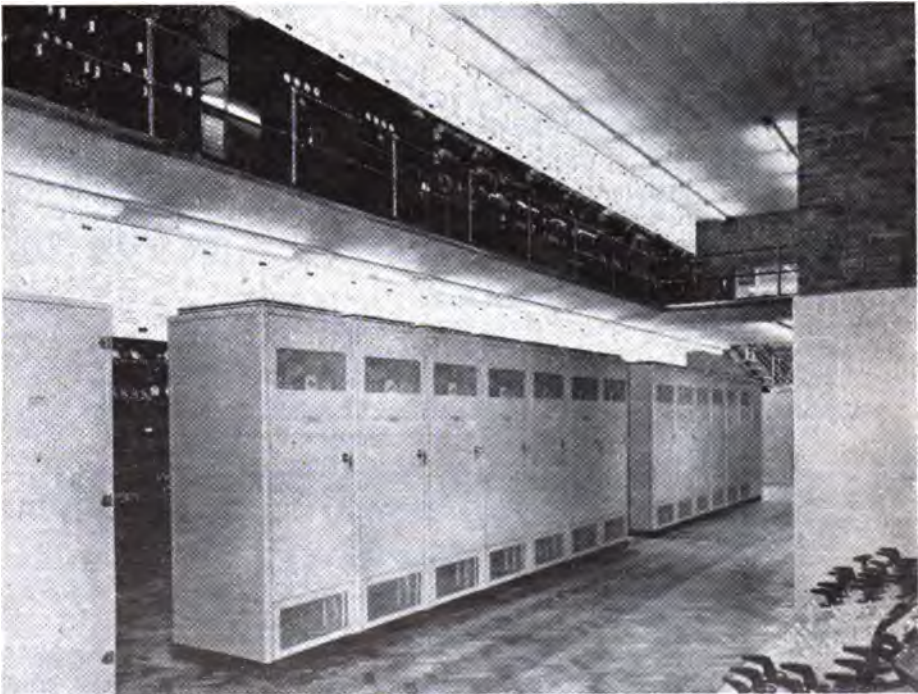


Fig. 7. Motor room viewed from top main motor. At the left, rear, are the converters for the table drive. In front of them is the Ilgner set, consisting of four generators, a flywheel, an induction motor and a tachogenerator solidly coupled together. In the far corner is the turntable m.g. set, driven by a 110 h.p. s.c. motor. In the foreground is the slab shear m.g. set, with the main exciter m.g. set beyond

Fig. 8. Magnestat and amplifier cubicles in the control room, with a.c. control panels above. All control gear is mounted in a sound-proofed room, with a.c. control panels and distribution switchgear in a gallery. The supervisory desk from which the operator looks through glazed screens on to the motor room can just be seen, right foreground



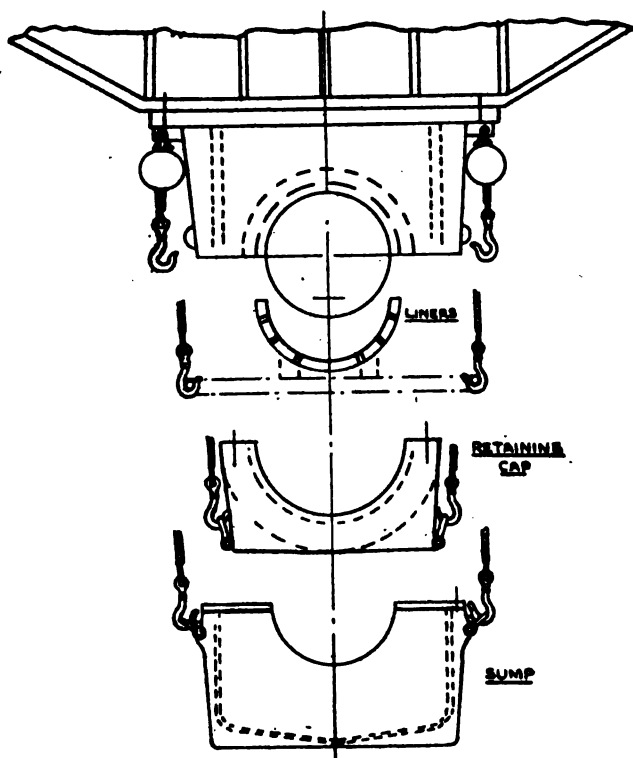


Fig. 9. Arrangements for dismantling the underslung jackshaft bearing for the top forward twin drive. (Compare Fig. 10.) The lowering tackle is built into the machine

motor generator set. Circuit-breakers and controls for the motors are mounted with the d.c. control panels in the control room. The shear is controlled from a desk mounted in the mill adjacent to the shear.

Roller Table Converter Control

The mill roller tables are in three sections, the d.c. motors for each section being supplied from two grid controlled convertors fed from a transformer. The three transformers have a common oil circuit-breaker.

The motors are reversed by means of pneumatic switches which operate at zero armature currents.

Auxiliary Sets

There are two main auxiliary sets (Fig. 7) running at 1,000 r.p.m. The first, the main exciter set, comprises:

- Synchronous motor exciter.
- Constant voltage exciter—80 kW.
- Two duplicate mill motor exciters—50/142.5 kW.
- Generator exciter—duplicate of the motor exciters.
- Synchronous motor, 1,000 h.p., 0.5 leading p.f.

Two duplicate screwdown generators—170/340 kW.

Two duplicate screwdown generator exciters.

The second, the slab shear motor generator set, comprises:

- Synchronous motor exciter.
- Shear generator exciter.
- Synchronous motor, 1,000 h.p., 0.5 leading p.f.
- Two duplicate shear generators—320 kW.

The synchronous motors supply leading reactive kVA to improve the power factor of the installation.

Other smaller sets include the feedroll and turntable motor generator set, comprising a 110 h.p. squirrel-cage induction motor and six 13.75/27.5 kW generators, two supplying feedrolls numbers 1 and 2 and four supplying turntables numbers 1, 2, 3 and 4, and a pilot exciter set comprising a 15 h.p. squirrel-cage induction motor coupled to a 2.5 kW generator pilot exciter, a motor pilot exciter and a current limit reference exciter.

Ventilation

In order to exclude the maximum possible amount of dirt and dust from the motor room and basement, the basement is pressurised and sufficient leakage is allowed to maintain an outward flow through the motor room. A low-level air intake could not be used as the motor room is in the centre of existing buildings, so the air is taken from a level well above the motor room roof and ducted into an air filtration house alongside the motor room. The air is then drawn through viscous filters by five fans, three (each 30,000 c.f.m., 1.5 in. water gauge) discharging into the motor room basement and two (4,000 c.f.m., 4.5 in. w.g.) supplying air to the two shear motors. The air supplied to the basement provides a make-up for three recirculating systems and a number of straight-through systems. These are as follows:

1. *Mill Motors.* Air is taken from the basement by two 33,000 c.f.m., 4 in. water gauge fans into a plenum chamber, from which it passes through the two mill motors, then through two coolers back into the basement. To avoid carbon dust fouling the motor room air 4,000 c.f.m. of air is taken from the motor room and drawn over the motor commutators by a single fan. The air is then discharged outside the motor room.

2. *Ilgnr Set.* The Ilgnr set air is taken from the basement. Two 32,750 c.f.m., 3.5 in. water gauge fans draw air into a plenum chamber, then through the generators an outlet air duct and through two coolers back into basement. The Ilgnr set motor takes its own air from the basement by means of fans on the motor rotor and returns it to the outlet air duct from which it is returned to the basement through the same coolers as the generator air. The flywheel takes 5,000 c.f.m. of air from the basement and discharges it into the motor room. Air is taken

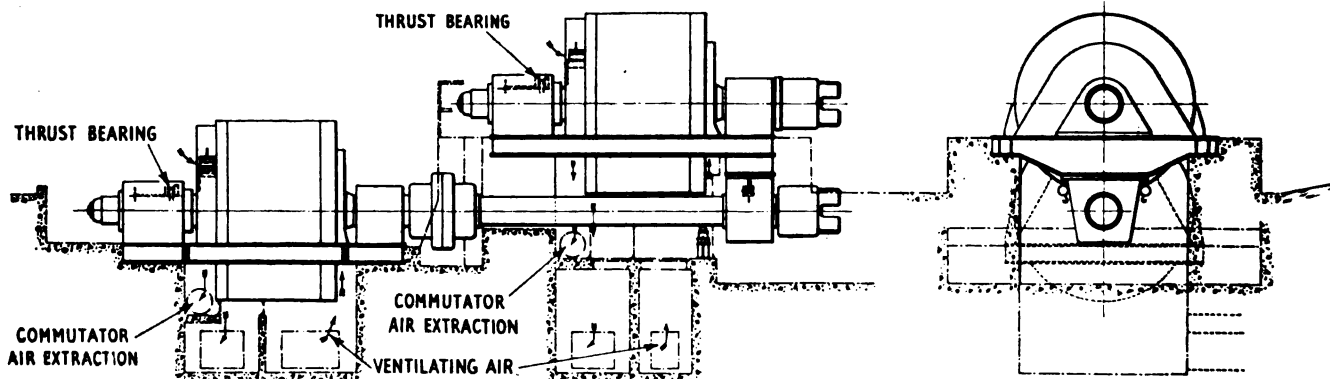
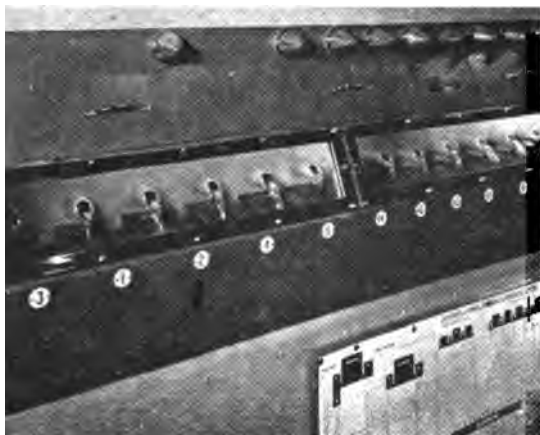


Fig. 10. Elevation of reversing mill drive, showing bearing and ventilation arrangements



lubricating display unit showing oil returning from bearings discharging into coarse strainer baskets

motor room and drawn over the generator commutator by two 6,500 c.f.m. fans and then discharged into the same duct as the mill motor commutator air.

Two main systems thus take air to the machines in the basement and return it to the basement through

six convertors have their own recirculating fans. Each convertor has its own fan which takes air from the plenum chamber beneath the convertor cubicles and draws it over the convertor tanks into a duct at the top of the cubicles. From this duct it is drawn through control cubicles by means of a further fan, and then back through a cooler into the plenum chamber.

A make-up grille is provided in the side of this chamber to draw make-up air to be drawn in from the motor room basement. Heaters are provided and modulating valves are used to control the water flow through the system so that the convertors are maintained at an almost constant temperature.

Ward-Leonard auxiliary motors are supplied with power from the basement by means of two of three 5,750 h.p. motors. The third fan is a standby.

Lubrication

A comprehensive lubrication system is provided for the machinery in the motor room. The lubrication system is located in a corner of the motor room basement. Motor-driven flood-oil pumps are mounted on a common oil tank. One pump is a standby. From the pumps, oil passes through a motor-operated self-cleaning filter through one of two coolers (one again being a standby). Part of the supply is then passed back to a cooler at one corner of the tank which forms a pocket of cooled oil for the suction side of the high-pressure pumps. This pocket is separated from the hot oil by a weir, the level of which is slightly below the oil level of the tank.

The remainder of the flood oil supply passes to the control point which consists of a long, narrow tank with top and interior lighting. At the top of the control tank is a header pipe from which the following five supplies pass through flow switches:

- Top mill motor—thrust (non-drive end) bearing.
- Bottom mill motor—thrust (non-drive end) bearing.
- Igniter set—eight bearings.
- Main exciter set motor—two bearings.
- Shear motor generator set motor—two bearings.

After the flow switches each group is subdivided and individual control and stop valves control the supply to each bearing. The control valves are mounted in a line along the top of the control tank. The oil from each bearing is returned through a nozzle at the back of the tank into an open basket strainer. The supply to any bearing can be set by means of the control valve and the effect can be gauged immediately by measuring the flow from the corresponding oil nozzle from that bearing which is directly below the control valve. Dirty or damaged bearings can, therefore, be detected and isolated at the control tank. The oil from the control tank drains back into the main oil tank.

From the cool oil pocket of the main oil tank suction, pipes are taken to high-pressure pumps for the mill motor and Igniter set flywheel bearings.

The thrust bearings at the non-drive ends of the mill motors are supplied with flood oil from the control tank. The five journal bearings are arranged for continuous high-pressure oil lubrication by individual pumps driven by a single motor. The flood oil supply to the thrust bearings is indispensable (this is the main reason for the provision of the standby cooler and pump on the main oil tank) but the journal bearings have standby discs and scrapers which will provide adequate lubrication for very long periods if the high-pressure oil supply fails.

All the Igniter set bearings are arranged for continuous flood lubrication and the two flywheel bearings are also supplied with high-pressure jacking oil during starting. A high-pressure pump is provided for each bearing, the pumps being driven by a common motor. The jacking oil supply has to be established, as detected by flow switches in the return pipes, before the flood supply can be started. Standby lubrication is provided on the flywheel bearings by disc and scraper and on the remaining bearings by oil rings.

The bearings of the two synchronous motors on the main exciter set and the shear motor generator set are arranged for flood oil lubrication and have oil rings for standby supply.

All bearings are fitted with oil temperature gauges with electrical contacts for alarm and shut-down if the bearing temperature becomes excessive.

Mill Pulpit

The air-conditioned mill pulpit is mounted on the opposite side of the mill from the motor room looking diagonally onto the ingoing end of the mill (Fig. 4).

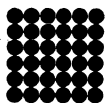
The mill operator sits at a desk in the pulpit and controls the main mill drive by means of a lever-operated controller mounted in the desk. The main roller tables are normally controlled with the mill, but the control of some tables can be transferred to the shear desk or to the 96 in. mill operator by means of selector switches on the plate mill desk. A mimic diagram on the right-hand side of the mill operator shows which control positions have been selected.

Selsyn-operated screwdown indicators and a load-balance meter are mounted on the mill side of the pulpit just below the operator's line of sight to the mill.

Acknowledgement

The author wishes to thank Alcan Industries Ltd. for permission to publish this article.

(Part 2 of this article discusses control features of the installation.)



R.N. electrical engineering

I.E.E. PRESIDENT SURVEYS ELECTRICITY AFLOAT

ELECTRICITY has been used in the ships of the Royal Navy since the 1870s, when electric firing of guns was introduced. In his inaugural address to the IEE last week, the president, Sir Hamish MacLaren, K.B.E., C.B., D.F.C., LL.D., B.Sc., M.I.E.E.,* traced the growth of importance and complexity of warship electrical installations from that time onwards. His account was detailed and kept close to engineering facts with few of the wider observations incoming presidents sometimes permit themselves. At its conclusion, Sir Hamish looked ahead to a drive for increased reliability and reduced weight in all types of equipment afloat, and to the generation of power at voltages above 440 and frequencies higher than 60 c/s. Already, electricity accounts for 30% of the cost of a warship.

Wartime Lessons

In a necessarily shortened account of Sir Hamish's address, the interest of the early years must be passed over. The war of 1939-45 brought to the forefront problems still exercising naval electrical engineers. Prominent amongst them was that of shock effect on electrical equipment. One of the first warships to suffer from the magnetic mine was HMS *Belfast*, and it was found with some consternation that the mechanical shock imposed by the underwater explosion was sufficient to immobilise the ship by the extensive damage it did to the electrical installation.

Immediate action was taken to improve design, which in this respect had previously been based on vibration caused by detonation of weapons in the ship rather than the effect of high explosive directed at it. A new testing machine was rapidly developed and supplied to manufacturers, and the ideas passed to the US Navy. Evaluation of shock has remained an important part of the work of the ship department of the Navy.

Another ship casualty which caused revision of electrical thinking was HMS *Ark Royal* in November, 1941. Although only one torpedo hit her, the resulting explosion was disastrous because it resulted in flooding of a boiler room and the main switchboard room. The inaccessibility of the main switchboard meant it was impossible to close circuit-breakers by remote control to restore services; and hand operation was impossible because of the state of the ship. The fatal situation arose because control wiring from the main board was always energised.

The solution evolved was use of a relay system in which the energising power to operate or maintain the breakers in their open or closed state was contained within the c.b. enclosure. A change of state was achieved by energising the control coil of a relay, otherwise dead. In emergency, energisation could be supplied by a secondary battery. This arrangement made it possible to introduce secondary control positions for sections of the ring main distributed throughout the ship.

* Sir Hamish was, until recently, Director of Electrical Engineering at the Admiralty.

Another lesson learnt from the loss of *Ark Royal* was the need to have generators capable of maintaining essential supplies after steam had been lost. A programme of installing standby diesel generators was put in hand.

Post-war Progress

Growing load on board ships soon made it clear that the d.c. ring-main system could not meet all requirements. The limit of capacity of single generators with existing ring-main switchgear was 500 kW, and 1,000 kW minimum was needed for ships being designed at the end of the war. Investigation showed that weight could be saved, even in a relatively small warship with a total of 1,000 kW installed generator capacity, by adopting 400 V 60 c/s three-phase a.c. distribution. Such a system had been used by the US Navy for some time; 440 V as the basic system made possible 115 V single-phase for lighting and small power loads, a voltage suitable from the aspect of mechanical strength of filaments, and also from the shock risk point of view. Although there was a theoretical case for a frequency higher than 60 c/s, it was felt that to take advantage of this would involve a scale of departure from standard designs difficult to justify.

Consideration was given to 50 c/s to meet land practice in this country, but the added weight penalty resulting from the lower speed was felt quite unacceptable.

When working out the details of the new a.c. system, it was necessary to lay down voltage regulation standards. It was decided to base design on the use of rapid-response a.v.r.'s with the cable system designed to give minimum practicable voltage drop. This obviated the need to incorporate voltage stabilising equipment in some classes of apparatus. The voltage limit set at generator terminals was $\pm 1\%$, with the drop due to starting the largest induction motor not to exceed 15%. After such a voltage drop, recovery to $\pm 1\%$ regulation was required within 0.3 sec, later extended to 0.5 sec.

Some conversion to 400 c/s and 2,400 c/s was necessary, the frequencies being nominal and in general the supplies taken from induction-motor driven generators. D.C. supplies are now being taken from silicon rectifiers.

No earthed neutral was provided on the 440 V three-phase system. Earth faults were indicated at switchboards, and dealt with by maintenance staff as soon as possible. In view of the shock risk, all 440 V equipment was provided with "difficult access" covers. Main switchboards were totally enclosed with dead fronts.

One of the requirements of a warship electrical system is that it should be operable after extensive damage. Emergency cables are an important asset in this respect, and they are provided with plug-in connectors which have safety sleeves which retract when the plug is inserted in the appropriate socket. The plugs can be inserted only in the appropriate phase socket and are locked by an insulated key. In cabling generally, substitution of poly-chloroprene for lead sheathing has been a weight-saver.

AROUND THE TRADE

BY PEREGRIN

A few days of October Indian Summer brought much rain that the autumn trade is off to a good start. Fires, and particularly convectors, are in, but in spite of so many wet washdays spinners show no sign of life. The public appears to be increasingly conscious of the value of the fire in a cold corner—due, probably, to better publicity change to the term “space heater” conveys the ordinary mind than convector; the relative radiation and convection have usually to be in words of one syllable! There are now far more makes, shapes, sizes and colours to choose from, but the ever-increasing difficulty of deciding what to buy is a daily problem. The customer wants yellow when the dealer has chosen to stock red. Of course one can always order the yellow, but taking verbal orders from the customer is many pitfalls. With old customers the matter is simple but with strangers all sorts of problems arise. In fact customers swear they have never been in the shop when confronted with their name, address and order in the book which all good traders have for that purpose. The true fact is that on the way something else has caught their eye in another shop, and, buying it, they have ignored the small matter of cancelling the first request. Taking a deposit—*if* you can persuade the customer to take it—will pay the balance. Otherwise you may be left with an odd book-keeping entry which cannot be

the idea of the design. I have sold one make after another of firelighters as they have come on the market, since the days of the pre-war Morphy-Richards, and have seen them all burn themselves out and fade away—but this one should stay the course: I shall lose no time in trying it out. Also I see it can be used for lighting the garden incinerator or bonfire—pity it will not act as a miniature flame thrower on my garden paths.

Retailing and N.E.C.T.A.

I was pleased to hear that Mr Dennis Jones had been appointed by NECTA to be responsible for the retailers' service side of the association. By the way, I hope both Mr Jones and the chairman of the Retail Committee had the opportunity of enjoying the GEC hospitality. Retailing is quite a separate and different kind of job from contracting and, I am afraid, many of the large contractors neither realise nor care about the difficulties which beset the retailer, large or small: Therefore NECTA did not seem to me to be competent to deal with these difficulties without some separate department. Since the Retail Committee was formed, great progress has been made, but still without that urge that such a committee should have behind it. Perhaps with the advent of Mr Dennis Jones and—dare I suggest it?—a slight change of name, we may see ever greater results. Staff training is to be one of his objects, and I should say not before time. The level of staff interest, knowledge, and intelligence so often seems to bear little relationship to the expense of keeping them in a job. And this also applies to apprentices on the contracting side. These apprentices are a real problem and an expensive proposition today, when they have to be paid while they are taught their three R's before they can start to assimilate some of the more technical details. Often they attend day school in their employer's time, and dodge the evening classes in their own. Some leave the course or the employer, or both, before the end of the term and the results when some of the reports come through are deplorable. One fellow-contractor tells me he has wasted over £165 in the last three years on this type of youth, but he did not enthuse no end over the very few ewe lambs who had stayed the course and made the grade.

Recruiting

Now we have reached the post-war birthrate-bulge youngsters we may have a chance to pick some better types for our section of the industry. The pity of it is that any sign of brains in the youngster usually means a university course: With the result, as one professor put it, that usually only one in a class of would-be scientists is really worth the money expended on his training. The others are mediocre stuff who could have made good plumbers, carpenters and electricians, as distinct from the hewers of wood and drawers of water. Perhaps it is time the more skilled work-a-day jobs were viewed in a different perspective by headmasters to whom success seems only to mean scientists and teachers.

Orders

A problem of orders occurs all the year round, but just before Christmas when trade is brisk and short. It is the same with some refrigerators in winter; one good spell of really hot weather and the stock is sold out, although the manufacturers have to wait until winter to get ready. I can never make up my mind whether it is lack of faith in their own goods that is the cause, or dissipation of energies over too many anxieties to ensure complete clearance of the stock so that they can bedevil the poor trader with a new gimmick or trimming to make his stock sell. I am sure that the Domestic Appliance Fair, if it were to materialise, could have done a lot to help with the trade settle such problems, and like the man who saw RIP on a big flat tombstone, I feel I mean Rise If Possible!

BT

Reminded that earlier this year I asked what had happened to the new GEC firelighter, which had not made its appearance on the market. I hear this was decided last month at the British Coal Utilisation Training Centre, accompanied by the usual light fittings. As I was unable to attend the demonstration discovered whether they boiled the kettle or lit by the firelighter, but I must say I like

50 c/s system

ELECTRIFICATION CONFERENCE

General view of the 25 kV overhead structure and wiring between Colchester and Hythe on the Colchester-Clacton-Walton line, Eastern Region, British Railways

DISCUSSION on the first series of technical papers to be presented at the BTC conference on 50 c/s traction got under way on Tuesday of last week. In our issue for last week we referred to the opening of the conference and exhibition and summarised the salient points in the series of papers dealing with power supply, which included those presented by Mr W. J. Webb, assistant systems engineer, BTC, and Messrs W. Casson and W. L. Kidd, of the CEGB. The discussion on these papers is reported later in this article.

Systems Measurements

The session on Tuesday was opened by Mr J. A. Broughall, Development Engineer, BTC, who outlined the techniques developed for tests on British Railways' 50 c/s systems which are believed to be the first applications of their type in the world.

Systems tests carried out on sections of the Eastern Region scheme are aimed at obtaining a picture of electrical performance of the traction system as a whole, assessing the performance of individual items of electrical equipment and measuring the effect of a.c. traction on signalling and public communication systems.

Knowledge of the precise way in which electrical traction systems behave will enable close programming of trains and the preparation of accurate timetables. More exact knowledge of train and system capabilities should enable the loads which may be attached to locomotives to be assessed with the certainty that locomotives and rolling stock are being efficiently employed.

Although the systems tests are in their initial stages, the method shows considerable promise. The various quantities to be measured are first converted by transducers, potential dividers and similar apparatus into d.c. voltage signals. These signals are fed to digital recorders each scanning a group of 12 readings every two seconds. Tests made on the Colchester-Clacton line used fixed recording equipment sites along 18 miles of track and a further eight units mounted on multiple stock. All the recorders were controlled remotely, either by wired circuits for the fixed items or by carrier frequency signals impressed on the overhead wire for the train units. On this first trial about 140 variables were recorded varying from the 132 kV grid voltage to movements in fractions of an inch. The various readings were punched on tape and fed to a digital computer for analysis.

Mr Calverley (E.E. Co.) thought the systems tests might be valuable if applied to d.c. traction schemes. He quoted the case of rectifier current waveform which is, in general, far removed from the theoretically expected shape on

traction systems. He asked if a train position could accurately be determined by systems test equipment. In Mr F. J. Lane, co-author of the paper, said that although train pick-ups were only sited at mile posts, it was possible to obtain the actual train position with great accuracy from the readings taken by an integration technique.

In the discussion, Mr C. C. Ingles (BTC) said the mission were operating 14 computers with one devoted entirely to scientific and engineering analysis of peculiarities to railway systems.

Comments on a method of insulating under track were made by Mr T. W. Wilcox (Merz and McIlwain) who described the use of butyl rubber shields between the catenary wire and the underside of the track where clearances were exceptionally small. The essence of the device was to allow a controlled discharge to the surface resistance of the shield under certain conditions, for example, when the pantograph lifted the contact wire, when excessive pollution from a locomotive lowered the dielectric strength or when a transient voltage appeared on the line. On one installation no damage to the insulation shielding was noted although discharges exceeding 2 A and numerous lighter discharges occurred.

Locomotives

The salient design features and specification requirements for the locomotives were outlined by Messrs J. A. Broughall and Kibblewhite, BTC. (Some of the constructional details were dealt with in *ELECTRICAL TIMES*, 29 Sept. describing the Battersea Wharf exhibits.)

Requirements for the different regions vary considerably. For the London Midland Region, mixed traffic locomotives

Principal Papers Presented at the Conference

The Application of the 50-cycle System as Proved by Systems Tests—J. A. Broughall, B.Sc.(Eng.), M.I.E.E., F. J. Lane, O.B.E., M.Sc.,
The Locomotives—E. S. Cox, M.I.Mech.E., G. G. Kibblewhite, B.Sc.(Eng.), A

The Multiple-Unit Trains—H. Wilcock, B.Sc.(Eng.), A.M.I.E.E., C. J. Clemow, B.S

The Power Supply—W. J. Webb, B.Sc.(Eng.), M.I.E.E.

The Overhead Line Equipment—E. Claxton, B.Sc.(Eng.),

Research for A.C. Traction—Dr F. T. Barwell, Wh.Sc., B.Sc.(Eng.), M.I.Mech.E., A

Signalling & Telecommunications—A. W. Woodbridge, M.Sc.,

The Interference Problem—H. R. J. Klewe, D.Ph., M.I.E.E.

on British Railways

PAPERS AND DISCUSSIONS

Electronic digital recorders at Colchester. As many as 140 variables, ranging from kilovolts to fractions of an inch, are monitored with precision whilst normal traffic is running



will be most suitable but, for the eventual electrification of the Eastern Region main line, freight haulage will predominate. The initial fleet consists mainly of mixed traffic locomotives, but five will have a lower gear ratio to enable experience to be gained with high-speed freight haulage. Because of difficulties in adapting existing wagons, this duty will be of a limited nature for some time.

The locomotives were specified to be capable of hauling a 475-ton train at 90 m.p.h. on level tangent track with a maximum speed of 100 m.p.h. An average speed of 67 m.p.h. under typical conditions would give a 9% improvement on steam locomotive timing for express trains. Freight haulage requires a 950-ton train to maintain an average speed of 45 m.p.h. and, recognising that bad fog conditions are likely in this country, it was also specified that no damage to the electrical equipment must result through running at 10 m.p.h. for 10 miles.

Track limitations required a maximum axle weight of 20 tons, a minimum wheel diameter of 48 in. and the fitting of flexible drives. As far as possible, standardisation has been introduced especially for equipment handled by the train crews.

It was necessary to consider the alternatives of mercury-arc or semi-conductor rectifiers, the most suitable design of traction motor and the auxiliary equipment.

The driving motors were to be designed to give good commutation with a current ripple of approximately 30%, and brush life was specified to be of the order of 60,000 miles with an interval between major overhauls of 250,000 miles. So far little test information is available, but two problems to be resolved are ways of obtaining more room in the locomotive body and whether the flexible drive between the motors and driving axles is worth the many thousands of pounds it adds to locomotive cost.

In the discussion, Mr Wayman (AEI) applauded the decision to obtain track measurements and to remove, as he put it, locomotive design from the metaphysical to the engineering field. The tests would probably be the first made and it was to be hoped they would resolve the many theories on motor suspension.

Two French representatives referred to developments on the SNCF system made in 1955, which confirmed many of the tests since made on British Railways. They referred to the coupling of axles as a means of increasing tractive effort and said silicon rectifiers had been found satisfactory for locomotives operating over several types of systems.

The great potentialities of 50 c/s systems over the d.c. system for future development were emphasised by Mr Ingles (BTC). He asked manufacturers to consider whether all their fuses and relays were really necessary. Simplifica-

tion had reduced maintenance in the past without impairing safety. Commenting on the difficulty of measuring track reaction, he said that work was proceeding and that one four-mile section of track had been equipped with strain gauges as part of a programme to find the precise cause and magnitude of stresses.

The question of sensing changeover between the 25 kV and 6.25 kV sections of track was raised by Mr Fukusake (Japanese National Railways). In reply, Mr Kibblewhite said inductors on the track adjacent to the section with changed voltage acted on magnetic pick-ups which operated relays in the locomotive. Other sensing devices were incorporated to ensure that the measured voltage change was due to a deliberate system voltage change and not to abnormally low system voltage such as might occur under fault conditions.

Multiple Unit Stock

On Tuesday afternoon the discussion was on two groups of papers, the first dealing with multiple unit stock for suburban and main line services, and the second with railway power supplies.

Mr C. J. Clemow (BTC), in a brief transcript of the paper by himself and Mr H. Wilcock, described the constructional requirements for the multiple unit stock. A large fleet of these units had been ordered to a specification which called for a maximum service speed of 75 m.p.h., a mean starting acceleration of 1.1 m.p.h./sec and the ability to start a loaded four-coach train from standstill on a 1 in 70 gradient with two motors cut out.

The electrical equipment included forced-air-cooled main transformers, rectifiers and traction motors, all mounted on the underframe, and a large measure of standardisation was introduced in the layout and general construction of the trains.

The transformers incorporated a four-section primary winding, and an electro-pneumatic tap changer for connection to either the 25 kV or 6.25 kV systems. Speed control is by secondary tap changing with current-limiting chokes or resistors.

In the supporting papers, details of the differences in applying the control and regulation to the motors on the four sections were described. For London-Tilbury-Southend, the English Electric arrangement incorporated mercury-arc rectifiers bi-phase connected across the four-section secondary of the transformer, the two outer sections being tapped to give the starting and accelerating steps. The motors, in series pairs, are each connected across one pair of rectifiers.



An AEI electric locomotive being lifted by electrically operated jacks at Longsight

For Glasgow suburban, an AEI arrangement incorporates mercury-arc rectifiers connected in bridge across the secondary winding, with equal tapplings simultaneously stepped from each end and the motors, in parallel, coupled between the secondary and rectifier mid-points. The AEI scheme for the Manchester-Crewe line provides for a bridge connected germanium rectifier across the transformer secondary feeding the four motors in parallel while the GEC plan for the Liverpool-Enfield-Bishop's Stortford line comprises two series pairs of traction motors each across a bridge connected full-wave mercury-arc rectifier circuit coupled to the tapped secondary winding of the transformer.

By the end of the year, over 400 of these multiple-unit trains will be in use and already satisfactory operation has been obtained with all types.

Discussion

A strong plea for reliability in electrical equipment was made by Mr W. J. A. Sykes (CM and EE, Southern Region). On the Southern Region, equipment needed adjustment every two weeks 30 years ago; today the minimum period was 4½ months and, should conditions prevent overhaul immediately, it could go for a further period of 4½ months if necessary. He hoped that the new stock would also have the same degree of inbuilt reliability. A further point was the capacity of a multiple train set to assist disabled trains. Had this been taken into account? Mr Clemow replied that both points had been fully considered and catered for.

Mr W. G. Jowett (English Electric) asked why Buchholz protection was used on the locomotives but not on the multiple unit stock transformers. Mr Clemow replied that the small clearances under the coaches where

solved were overload protection and over-temperature protection for semi-conductor rectifiers. He stressed the importance of cleaning. Mr S. B. (BTC) replied that this was the sort of opinion in which he was much interested. It was for the manufacturers to argue among themselves. As far as he was concerned, he was prepared to accept either mercury-arc or semi-conductor rectifiers so long as performance and price were satisfactory.

Mr Junkers (Netherlands Railways) questioned the difference in the speeds and accelerations between line locomotives and suburban multi-unit stock. Would not the latter be uprated to main line performance? Mr Clemow replied that it was a question of economics. The present figures had been agreed at an early design stage as the most economic for the conditions prevailing. Mr E. H. Jarvis (English Electric) asked if frequent replacement of contactor tips would not be avoided by the adoption of a form of control using transducers. The smoother acceleration would also assist in avoiding wheelslip. Mr Clemow replied that this was a possibility which was still under consideration.

Dr Thompson (GEC) referring to Dr Read's comment said that if indeed the mercury-arc rectifier was becoming obsolescent, like King Charles, it was an "uncomfortable time in dying." The steel tank type arc rectifier which had been installed on the railways had been in service after 20,000 miles running and were in excellent condition. This was admittedly only a moderate mileage for a motive but an examination of the units indicated that they were as good as new and rough riding tests showed that they were robust enough to stand up to the conditions normal to rail transport.



Power Supply

The group of papers dealing with the power supply were briefly outlined by Mr W. J. Webb (GEC) on Tuesday afternoon after which a discussion was invited. The first to respond was Mr J. E. J. Ank (Netherlands Railways). He asked why we did not take advantage of the improved load distribution which could be effected by power supply from adjacent substations. Mr

A multiple unit a.c. train with English Electric equipment as now in service on the Southern Region of British Railways

rectifier unit of English Electric design and construction as used on British Railways, Eastern Region, for the motor coaches of a.c. multiple unit stock

that this was related to the problems of taking power from the CEGB. Different sections of the 132 kV system were not necessarily in phase and to parallel them to the railway system would necessitate synchronising CEGB systems, apart from which the railway system would then also be transmitting part of the load between adjacent CEGB substations. Line voltage in respect of these loads would be registered on voltmeters and, presumably, charged for. In present circumstances, separate operation was essential for emergency working.

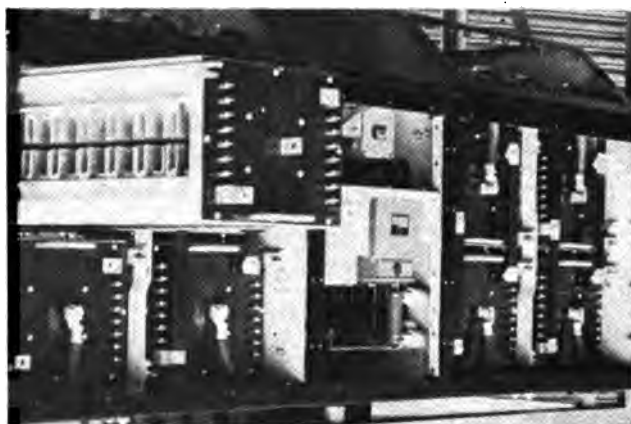
Mr K. Fletcher (Standard Telephones) said his experience was mainly on supervisory remote control systems. He played a significant part in reducing operational costs on the part of the staffs. Had adequate advice been given from experts on these systems and was there any room for improvement. Mr Webb replied that this had been given the fullest consideration at all stages; in fact, the techniques had so far advanced that it was now possible to install control cabins above ground with large windows so that the personnel had a good view of what was going on outside, a marked contrast to the underground, air conditioned "sealed cells" of a few years ago.

Mr P. Sayers (Chief Commercial Officer, CEGB) said that little had been said about economics. The railway had been given the most favoured rates for electricity supply which were based on a two-part tariff. On the main lines the load factor was exceptionally good, ranging from 60 to 70%; on the suburban lines it was averaging around 40%. Development of night freight traffic would enable more advantage to be taken of off-peak rates and would contribute to lower operating costs. Mr S. B. Warder agreed and said that there were being made to increase night freight traffic. It remained to be seen whether it was possible to persuade the public to travel instead of by day.

Overhead Line Equipment

On Thursday morning Mr E. Claxton, of the British Railways Commission, summarised his paper outlining the present problems on overhead line equipment for 25 kV and 6.25 kV. The first was an organisational problem in which the planning, construction and erection of new equipment had to be programmed and arranged with minimum interference to existing traffic over the line. If this work was contracted out on a competitive basis, it was essential that a careful specification be prepared so that the would-be tenderers to the railway had an accurate idea of the task in hand. In Britain, the task was complicated in that the space available for erection of trackside equipment was restricted and the large number of bridges, which in some places carried 1½ to 2 per track mile. Many bridges gave insufficient clearance for erection of even the 6.25 kV line and had to be reconstructed, but that was the civil engineers' headache.

View of a motor coach in a multiple unit showing the undercar mounting of the GEC rectifier and casing



Atmospheric Pollution

The atmospheric pollution in Britain was also on a scale not to be met with in any other country and this necessitated careful study of insulator and conductor behaviour against flashover and corrosion. In so far as insulators are concerned, solid core glazed ceramic types were used in general; semi-conducting glazes have not proved satisfactory through smoke and other deposits on the surface. Because of the pollution problem, long creepage paths had been adopted to reduce maintenance cleaning periods. 42 in. creepage paths are normal for 25 kV and 16 in. on 6.25 kV. Other and newer insulators are being tried, notably those incorporating p.t.f.e. and bonded fibreglass.

Under bridges butyl rubber mats are used where the clearance to bridge structure is restricted. The clearances adopted for the two voltages between load gauge and live equipment is 11 in. for 25 kV and 4 in. for 6.2 kV, but with the decline in the amount of steam traffic it is hoped to be able to reduce the clearances for 25 kV.

Discussion

Experience in France, where 2,000 km of 50 c/s a.c. line had been constructed in the last ten years, indicated that maintenance on special forms of insulation was disproportionately high. That was the comment of the first speaker, Mr J. G. Walter (SNCF) who, however, commended the optimism of British engineers in using the newer materials and wished them luck. In regard to the policy of using compound catenary for overhead cable support, he thought that this was unnecessarily expensive and, in his experience, two wire stitched catenary was adequate up to 100 m.p.h.





General view of BICC Group railway traction research laboratory at Tolworth

Brigadier Langley (M.O.T.) said that he was concerned with safety requirements and asked if the present 25 kV clearances were not reducible. Referring to the flashover tests which had been carried out between steam locomotives and the overhead line last year, these seemed to indicate that the existing minimum clearance was more than adequate. This was pertinent to the level-crossing problem where it was laid down that clearance gauges on the road approaches should be set to give a 1 ft 9 in. clearance between the top of the load and the live conductor. A system used in the Netherlands for isolating the 3 kV d.c. Belgian and 1,500 V d.c. traction systems in Holland was described by J. E. J. Ankerschmit. This was just a simple gap which allowed the pantograph to rise to its upper limit between the sections and he suggested that this might be more economic than the insulating sections adopted by the British Railways. The reply was that, at the speeds which we were using, the main problem was the proper re-establishment of contact between the pantograph and the wire which would need an extremely long run-in after the gap and where the insulating sections were close to bridges this would introduce constructional difficulties. Mr M. I. Yasuna asked why ice loading was allowed for on the catenary supporting cables but not on the conductor. Mr Goldring replied that the frequent passage of pantographs prevented ice forming on the conductor and no trouble had been experienced to date from this cause.

Research for A.C. Traction

In the paper on research presented by Dr F. T. Barwell (BTC), three aspects of research were given particular attention. These concerned track adhesion, current collection and insulation. Other aspects were detailed in the paper. Adhesion between wheel and rail, constituting the overriding limiting factor to the tractive and braking forces of locomotives and multiple unit stock, is a topic of extreme complexity. The basic causes of friction were still not completely understood. Oxydised steel rubbing against itself had a coefficient of friction of 0.6; why, then, do railways record much lower values and why do they fluctuate so much to their embarrassment? Why should the coefficient rise just before slipping occurs and why should it sometimes fall off as speed increases? These were questions going far beyond the ordinary field of applied research and needed the physicist's fundamental approach.

Studies of pantograph behaviour had been made from special equipment mounted on the vehicle roof. The effects

of rise and fall of the conductor catenaries had also been investigated. Newer forms of insulation were being tested under the conditions in industrial and areas which give rise to corrosion.

Dr A. L. Williams (BICC) said that he had long been concerned with research on overhead line construction and behaviour and was appalled at the vast programme which was ahead on current collection. He was particularly concerned with the experimental work on insulation done by the user rather than the manufacturer since laboratory research rarely approximates the conditions actually in service. In connection with adhesion, he asked whether any laboratory work was being done. Was it a suitable subject for university study? C. C. Inglis (BTC) said that, on this subject, the British Transport Commission, in connection with BEAMA, had recently sponsored

readership at London University on electric traction. It was hoped that this was where such studies could be carried out and not the least of the objectives was the one of raising the status of the traction engineer.

Signalling, Communications and Interference

On Thursday afternoon, papers on signalling and communications were presented by A. W. Woolf (BTC) and on the interference problem by Dr H. Klewe (BTC). In the former, the interests of the signalman and the electrical engineer in the running railway were described and the various methods of track circuiting used in the past were discussed.

On the subject of interference, Dr Klewe dealt with the general aspects of interference with adjoining signalling and telecommunication circuits by electric railway and the mathematics of induced e.m.f.s and screening and concluded with an explanation of the methods used by the BTC to combat interference.

The Guildhall Banquet

To mark the conclusion of the conference, a banquet was held at the Guildhall last Friday under the chairmanship of Lord Chandos, who proposed the toast "Lord Mayor and Corporation of London, to whom the Lord Mayor replied. The President of the Board of Railways, the Rt. Hon. Reginald Maudling, in proposing the toast of "International Co-operation," pointed out that the Great Britain had led in engineering, and other countries who had followed us had profited by our experience sometimes to our disadvantage in trade. Now that it came late to railway electrification, we could improve what had gone before. This was not a disadvantage.

M. Dargeou, Director-General of the French Railways, responded, telling of some early experiences in international co-operation. Essentially, from the very nature of the work, railwaymen were internationally minded, he said. He particularly stressed the work of the International Union of Railways.

In his capacity of president of the Locomotive and Allied Manufacturers' Association, Lord Chandos proposed the toast "Railway Modernisation." He said he believed in the future of railways, particularly now that our railways were becoming congested. They should offer better service and comfort. Sir Brian Robertson stressed that railways needed the equipment to do the job and, in the future, they will have it. Finally, the charming toast of "Auld Reekie" to delegates was proposed by Sir Leslie Gamage, president of BEAMA.

OVERSEAS NEWS



from our correspondents abroad

CANADA

Regulator Order

A Boveri (Canada) Ltd. have awarded an \$83,040 order for 12 regulators for the Carillon power now under construction for Hydro.

Columbia Step

Part on construction of power ment projects on the Columbia seems a little nearer following discussions in Ottawa a few days ago. Two teams of negotiators, from Canada and the USA, are now to submit a joint report to their respective governments for approval and this is expected to be the basis of a treaty which may be ratified early next year. According to Mr D. Fulton, who headed the Canadian team, the recommendation took account of the principles upon which the International Joint Commission last December (ELECTRICAL 17 Dec., 1959, issue). The Commission agreed on a 50-50 share of stream benefits, with power produced by the American side from dams in Canada paid to the host in cash, but in power.

SWEDEN

Increase

Consumption of electric power in Sweden in the fiscal year, 1959-60, rose by 2,100 million kWh, or 7%, compared with the previous 12-month period, according to a survey by the Swedish State Power Board. A comparison between the calendar years 1958 and 1959 show a rise of only 4.5%, which is considerably less than the estimated annual increase up to 1965, i.e., 10% per annum. A revised forecast for the period 1959-65 submitted by CDL, Central operations management of the power producers, foreshadows an annual increase in industrial consumption of power by 5.6%, as against 10% in previous calculations. However, at the same time the annual increase in domestic consumption, 10%, has been reduced downwards to such an extent that the overall increase in power consumption remains unchanged at 2,200 million kWh per annum. In its appropriate requirements for fiscal year 1961-62 the State Power Board asks for kr. 260 million (£18,207,000) for the construction of new power stations, kr. 30 million for nuclear development, kr. 40 million for regulation projects and kr.

124 million for network installations. By 1962, the Board says, the building of new stations should have reached such a stage that the resources will be able to cover the requirements, while new stations will be built mainly to meet the annual increase in power consumption.

GREECE

Power Supplies

Some weeks ago we reported that negotiations were in progress on a plan for Turkey to supply some 500 million kWh annually to Greece. We are now informed by Mr J. Flambouriaris, deputy general manager of the Greek Public Power Corporation, that this is incorrect, as no negotiations have been planned or taken place.

INDIA

Load Shedding in Delhi

Replying to a question, the commissioner, Mr P. R. Nayak, told Delhi Corporation recently that for the past two months supply of electricity had been suspended for 20 min periods by rotation in city areas during the evening peak-load hours. The questioner had referred to frequent breakdowns, but the commissioner pointed out that load shedding was deliberate between the hours of 7 p.m. and 9 p.m. The corporation's supply capacity was inadequate to meet demand and the gap was widening and difficulties had been accentuated by the Punjab Government insisting that Delhi should confine its power intake from Nangal to 20 MW. In recent months Delhi had been drawing up to 27 MW. It will be recalled that Delhi suffered a recent power cut owing to a boiler failure.

Plans for easing the electricity restrictions in Delhi include the provision of four thermal 50 MW power stations during the third Five Year Plan period. An allocation of Rs 17.5 crores to the Delhi electric supply undertaking has been recommended. One of the 50 MW stations will be built by the Punjab Government as a standby for Delhi and Rajasthan but it will remain under the control of the Delhi supply undertaking.

PAKISTAN

Wire and Cable Plant

The Pakistan Government have approved the establishment of a \$6½ million rod, wire and cable manufactur-

ing plant by the American firm, Phelps Dodge. The plant will roll copper and aluminium into rod from copper-wire bars and aluminium ingots, respectively. Planned to have sufficient capacity to meet the entire requirements of the country, the plant will be built near Karachi and is expected to be in operation within a year.

AUSTRALIA

Third 200 MW Set

A repeat order for a third 200 MW steam turbo-alternator for Vales Point power station has been placed with the English Electric Co. Ltd. by the Electricity Supply Commission of New South Wales. With auxiliary plant manufactured in Australia the contract is worth £A2½ million. English Electric already have orders for the first two 200 MW sets for Vales Point station, which is being built 70 miles north of Sydney. The steam turbine is of the three-cylinder design arranged in line. Steam temperature at the t.s.v. is 2,350 p.s.i.g. 1,050°F, with reheat at 1,000°F. The feed heating and condensing plants will be made in Australia. The machine is similar to those already in service at the CEGB's High Marnham station.

Street Lighting Subsidy

The New South Wales Minister for Local Government, Mr Hills, is to ask the State Government to subsidise local councils on a £-for-£ basis in a £5 million street lighting improvement scheme extending over the next five years. This is the outcome of the recommendations of the committee set up by the State Electricity Authority to investigate the improvement of street lighting. The committee's survey had found that there was a large deficiency in street lighting along classified traffic routes.

Power Plans for Queensland

Some of the recommendations for meeting power requirements in Queensland over the next 20 years, prepared in a report by the consultants, Merz and McLellan, were revealed recently. They include a 360 MW power station on the Callide coal field in central Queensland, capable of supplying power from Central Queensland to the New South Wales border. Adoption of the recommendations are being deferred until alternative schemes have been investigated. These include plans to use natural gas from Roma, which could possibly be piped to a power station in Brisbane.

Personalities *in the industry*



Mr R. M. Gravett



Mr D. R. S. Turner



Mr A. Hunking



Mr J. F. Bird



Mr R. D. V. Roberts

Commercial officer for No. 3 sub-area of the Merseyside and North Wales Electricity Board, **Mr R. M. Gravett**, M.I.E.E., has been promoted to be the Board's assistant chief commercial officer responsible for industrial development. He succeeds **Mr W. B. Parkinson**, B.Sc., A.M.I.E.E., who was promoted chief commercial officer recently (*ESH, pages 136-138). Mr Gravett, who is 58, received his training with the Electric Construction Co. Ltd. and later with the Wolverhampton Corporation. He then joined the Shropshire, Worcestershire and Staffordshire Electric Power Co., moved to the staff of Ealing Corporation as distribution superintendent, and later became deputy borough electrical engineer and manager at Nuneaton. Immediately before joining the Manweb staff on nationalisation, Mr Gravett was electrical engineer and manager for Hoylake UDC.

Commercial manager of the AEI Turbine-Generator Division at Manchester since 1958, **Mr D. R. S. Turner**, B.A., A.M.I.MECH.E., has joined Davidson and Co. Ltd., of Belfast, as a director and general manager. Mr Turner gained his early engineering training and experience with BTH and was turbine sales commercial engineer with that concern from 1946 to 1950, when he was promoted to assistant manager, Turbine Sales Department. Three years later he became assistant general superintendent, Rugby Works, with special responsibility for what was then designated "the Larne project"—the new works of the BTH Co. in Northern Ireland. In May, 1955, he was appointed manager of those works.

Mr J. V. Sheldon has been appointed sales director of Simplifix Couplings Ltd.

Mr L. W. Honey, ASSOCIATE I.E.E., has been appointed to the board of Marryat and Scott Holdings Ltd. He is also joint managing director (Hounslow works) of the subsidiary company, Marryat and Scott Ltd., which he originally joined in 1919. He became chief estimator in 1925, export manager in 1931, a director in 1942, and joint managing director in

1953. He is also managing director of John Bennie Ltd. and chairman of Austin Lifts Ltd., two other subsidiaries.

Mr R. E. Huffam has been re-elected president of the British Standards Institution for a third term of office.

Atlas Lighting Ltd. announce the appointment of **Mr R. A. Bibby** as representative in Northern Ireland. Mr Bibby joined Thorn Electrical Industries Ltd. as a representative seven years ago, covering part of the West Riding of Yorkshire, and later transferred to the Manchester branch.

Mr A. Hunking, B.Sc., managing director of Westool Ltd., has been elected to the board of the Warner Electric Brake and Clutch Co., of Wisconsin, USA, whose foreign operations include a wholly owned subsidiary in Switzerland and affiliated companies in France, Germany and Japan. Westool manufacture under licence from the American company the Warner electro-magnetic clutches and brakes. Mr Hunking became managing director of Westool in 1946 and prior to that he was associated with the Federation of British Industries, which he joined in 1928.

A. Reyrolle and Co. Ltd. announce that **Mr J. F. Bird**, M.C., T.D., B.Sc., M.I.E.E., has been appointed the company's overseas manager. A native of Newcastle upon Tyne, Mr Bird was educated at the Newcastle Royal Grammar School and at Armstrong College where he gained his B.Sc. degree with first-class honours. He joined Reyrolle's as a student apprentice in 1932 and took up duties with the Technical and Research Department in 1937. After war service with the RA, during which he reached the rank of major and was awarded the M.C., he returned to the company in 1946 and took charge of the Short-Circuit Testing Station until 1949 when he became engineer-in-charge of testing and certification. He was a member of the IEE Council from 1951-53 and, with Messrs Christie and Leyburn, was joint author of a paper on "The Testing of Large Circuit-Breakers" which

was awarded an IEE premium. Mr Bird joined the Overseas Commerce Department in 1954 and, in May, was appointed manager of A. R. and Co. (Rhodesia) Ltd., of which company he is also a director. He will take up his new appointment later this year.

British Radio Corporation announce that **Mr H. C. Goodman**, assistant sales manager, Marconi radio and television, has been appointed sales manager of that Division. **Mr Frank Jones** is retiring.

The Electricity Council have appointed **Mr R. D. V. Roberts** as industrial relations adviser to the Council (page 46). Mr Roberts entered the electricity supply industry in 1948 as welfare officer to the then British Electricity Authority, but soon after took up the post of secretary to the North Joint Advisory Council of the electricity supply industry, the body set up by the Electricity Act of 1947 to conduct a joint consultation in the industry. In 1953 he was additionally appointed deputy director of welfare to the constituted Central Electricity Authority. On the creation of the Electricity Council in 1958 he was appointed industrial relations adviser and, in that post, succeeds Mr D. G. Dolgellau. Mr Roberts is well known in the field of industrial relations and personnel management in the industry and needs no introduction to the many organisations with which he has worked for so many years. A native of Dolgellau, North Wales, who was educated at the Dolgellau Grammar School, Mr Roberts proceeded to the London School of Economics where he took the degree of Bachelor of Commerce of the University of London. He has some experience as a journalist and was editor with a number of publications. Mr Roberts was appointed in 1951 as assistant secretary to the South and Monmouthshire Council of the Service in Cardiff and later held the appointment as regional officer for

nal Council of Social Service in Wales. In 1941 he was appointed officer for the Miners' Welfare Commission in the Northumberland and Durham coalfields and later became the chief district officer of the Commission in London, a post he held till

T. S. M. MacLean, B.Sc., Ph.D., I.E.E., has been appointed lecturer in Department of Electrical Engineering at Birmingham University.

For new appointments in their sales organisation are announced by the firm: **Mr P. E. Hoskins**, formerly manager of the north west branch at Pool, has been appointed branch manager of the south east branch at Oxford; **Mr P. R. Goode** has been appointed branch manager of the north branch at Liverpool in succession to Hoskins (Mr Goode was formerly district manager at Oxford); **Mr R. J. E. M.** becomes district manager at Oxford (he was formerly district manager at Cheltenham) and **Mr H. R. Red-** has been appointed district manager at Cheltenham (he was formerly staff in-charge at the Bristol Hoover sales-school).

Professor B. Bleaney and **Dr James** have been appointed members of Council for Scientific and Industrial Research. Together with a third member to be appointed they succeed **Professor M. S. Blackett**, **Sir Eric Ashby** and **Mr H. Douglass**, who have retired at the completion of their period of service.

J. E. L. Anderson, M.Sc., M.I.E.E., director of Associated Engineering Ltd. currently chairman of the IEE Education Section, has been appointed director and chairman of that firm's subsidiary, Aeroplane and Motor Aluminium Castings.

Hedley J. C. Gower, A.M.I.E.E., assistant to the engineering director of Granada TV, has been appointed chief engineer of Border Television Ltd. He begins his new duties on 1 Nov.

After a number of years manager of the London branch of W. T. Henley's Telephones Works Co. Ltd. (now part of the Woolwich Group), **Mr W. G. Gower** has retired, but is to continue to work in a consultative capacity on the side for AEI in the Brighton branch. To mark his 50 years' service, he was recently presented with a cheque for £50.

Mr J. C. Reed, formerly sales engineer of Birmingham Aluminium Casting (1903) Co. Ltd., has been appointed sales manager of the company.

Presentations have been made to two officials of the No. 2 area of the Durham Divisional Coal Board who retired at the end of September after a combined service of 90 years in the coalmining industry. The recipients were **Mr W. L. Tulip**, chief engineer for the area, and **Mr James L. Baker**, area electrical engineer. Both officials were with the old Lambton, Hetton and Joicey Collieries Ltd. before nationalisation of the mining industry.

Mr G. H. Thompson has been appointed president of Calgary Power Ltd., of Alberta; **Mr G. A. Gaherty** is chairman of the board. Mr Thompson has been with the company since 1925 and has held the positions of chief engineer, general manager and vice-president.

The Utilities Committee of Winnipeg City Hydro has recommended that **Mr D. C. Bryden** be appointed general manager in place of **Mr T. E. Storey**, who is joining the Manitoba Hydro-Electric Board (not the Power Commission as we reported last week). Mr Bryden, who is now assistant general manager of City Hydro, has been with that undertaking for over three years.

Mr W. J. Thomas, managing director of British Aluminium Co. Ltd. retires on Oct. 31, but will continue to serve as a director of the company and certain subsidiary and associated companies. **Mr J. J. Boex** has resigned as a director and an executive of the company with effect from Oct. 31.

Head of the B.P. Research Centre at Sunbury-on-Thames, **Mr E. S. Sellers, M.A., M.Sc., M.I.CHEM.E.**, has accepted the invitation to be president of the Junior Institution of Engineers for 1960-61.

As part of a general reorganisation of its sales staff, James Booth Aluminium Ltd. has appointed **Mr Arthur W. Williams, B.Sc., A.I.M.**, as chief technical representative in charge of the company's technical sales service department.

Mr G. A. Onion and **Mr P. L. Hollings** have been appointed directors of Dowding and Mills Ltd. following the death of **Mr A. E. Hollings**, managing director. Mr Onion is director in charge at the Birmingham works, and Mr Hollings at the London works.

Mr W. S. Lewis, C.B.E., J.P., COM.I.E.E., A.C.T.(B'HAM.) has been re-appointed chairman of the Midlands Electricity Board, to serve up to the end of 1961.

Mr L. J. Gooch, A.M.I.E.E., has been appointed to the board of Marryat and Place Ltd., the electrical contracting company in the Marryat and Scott Holdings group. Mr Gooch was apprenticed to the late Howard Marryat in 1914, became a director of Marryat and Scott Ltd. in 1942 and joint managing director in 1953. It is also announced that **Mr A. J. Bryant, F.C.A.**, has become secretary of Marryat and Scott Ltd. on the retirement of **Mr R. Walker** who remains secretary of Marryat and Scott Holdings.

From the London Electricity Board we hear of five new appointments. **Mr R. Thompson**, ASSOCIATE I.E.E., formerly manager of the West Bourne district, has been appointed to the Board's headquarters as management officer following the retirement, on 30 Sept., of **Mr C. W. Blake**. **Mr B. L. Wells, B.Sc.(ENG.), M.I.E.E.**, who was manager of the North Western district, becomes manager of the West Bourne district. **Mr R. C. Tuffnell, M.I.E.E.**, manager of the Regency district, becomes manager of the Central district in succession to **Mr G. H. Fowler, M.I.E.E.**, who has taken up engineering duties on the chief engineer's staff. **Mr F. N. Sherborne, A.M.I.E.E.**, now manager of the South Eastern district, succeeds Mr Tuffnell as manager of the Regency district. The two posts of manager of the North Western and South Eastern districts have yet to be filled (*ESH, pages 76, 77, 78, 81).

Formerly with the London branch sales office, **Mr H. M. Shellard** has been appointed manager of the Nottingham branch office of the Dictaphone Co.

OBITUARY

Mr W. J. Huggett, O.B.E., M.I.MECH.E., A.M.I.E.E., a co-founder of the Express Lift Co. Ltd., died on 5 Oct., aged 78.

Mr A. MacArthur, formerly a director of the International General Electric Co. Ltd., died on 7 Oct.

Mr James Rankin, O.B.E., deputy chairman of the Merseyside and North Wales Electricity Board until his retirement at the end of 1959, died on 9 Oct., aged 68. Mr Rankin, who was a solicitor, joined the North Wales Power Co. Ltd. in 1918 and became its secretary in 1929. From 1940 he was a director and general manager of that concern and Electricity Distribution of North Wales and District Ltd. and general manager of five associated electricity supply companies. He served on many important bodies connected with the industry including the former North Wales and South Cheshire JEA, the National Consultative Committee of the CEB and had been a member of the EDA Council. He was also a member of many committees concerned with the industry's consultative machinery.

N. G. Turner receives a £50 cheque from **Mr F. V. Jones**, commercial manager, AEI Cable Division. On left is **Mr D. Parsons**, manager, AEI Cable Division



* Denotes revision to the "Electricity Supply Handbook, 1960."

U.S.S.R. WELDING TECHNIQUES

EMPHASIS on the introduction of new and improved techniques to industry was the impression gained of Soviet welding research by a delegation of British welding experts which visited the USSR. Because of pressure of economic necessity, fundamental welding research was considered to be of secondary importance. Thus research workers in the Union were found to have excellent facilities for constructing prototype production equipment.

Friction Welding

Although automation and mechanisation of processes is the dominant theme in the Soviet welding research programme, a great deal of work has been

done on techniques suitable for areas where power supply is limited. Such techniques include friction welding, which is applicable to circular components rotated relative to one another and then brought together by pneumatic or hydraulic pressure. The pressure and the intense local heat generated provide conditions favourable to weld formation. This process is claimed to be more economical in electrical power than flash welding using a transformer.

While welding research in the Soviet Union is of necessity on a much larger scale than in the United Kingdom, in certain spheres as, for instance, inert gas shield welding of aluminium alloys, techniques are not so advanced as in this

country. On the other hand, there have been notable contributions to submerged arc welding of aluminium, titanium and copper alloys. Also of interest to the British delegation was work being carried out by the Russians on diffusion welding. In this method, the cleaned surfaces of two components are pressed together and heated in a vacuum, diffusion of metal atoms at the interface producing a weld between the two parts.

The delegation from the British Welding Research Association comprised: the director of research, Dr Richard Weck; the deputy director, Mr H. F. Tremlett; the assistant director, Dr A. A. Wells, and the chief metallurgist, Mr P. T. Houldcroft.

FINANCING ELECTRICITY SUPPLY

SOME of the outstanding subjects of controversy arising from the financial practice of the electricity supply industry are discussed by an Electricity Council deputy chairman, Dr R. S. Edwards, in an article in *Lloyds Bank Review*. He seeks to answer such questions as: do the prices charged for electricity cover the full costs; is there a high enough degree of self-financing; are budgets competently prepared; can electricity investment be adjusted upwards and downwards to help the general economy; is the problem of the peak load being vigorously tackled?

It is not surprising that the answers to these questions are favourable, and that they repeat much that can be read in the recent annual report of the Electricity Council. However, in developing his case, Dr Edwards has some important observations to make on the background to existing policy.

Depreciation and Borrowing

Depreciation provides a case in point. He argues that real costs are covered by the present method of depreciation on an historical basis. This is partly because there are inbuilt margins to take care of rising replacement costs. For example, entire cost is entirely written off over a conservative life, whereas plant in fact has a substantial scrap value, and is sometimes partly paid for by consumer's contributions. Further, due to technological advance, the effective replacement cost is not always rising, as is sometimes assumed; for generation plant overall it has fallen in recent years. Dr Edwards argues that there is no single "right" value of depreciation. What is allowed at present lies well within the acceptable range. Similarly, on borrowing, he feels that the industry pays a sufficiently high rate of interest (currently 6½%). The supply industry is strong enough to attract capital in any system. It could raise it without Government guarantee and still show a surplus on revenue working. (He excuses himself from discussing whether it would be desirable for the industry to go to the market without the present Government guarantee).

Dr Edwards thinks it unfortunate that the difference

between revenue and costs of electricity boards is called the "surplus." To the extent that they are not required to cushion the boards against short-term financial changes, surpluses are "planned as a small contribution from consumers towards development of the boards' undertakings." Nothing is "left over" in the colloquial sense.

Demand and Load

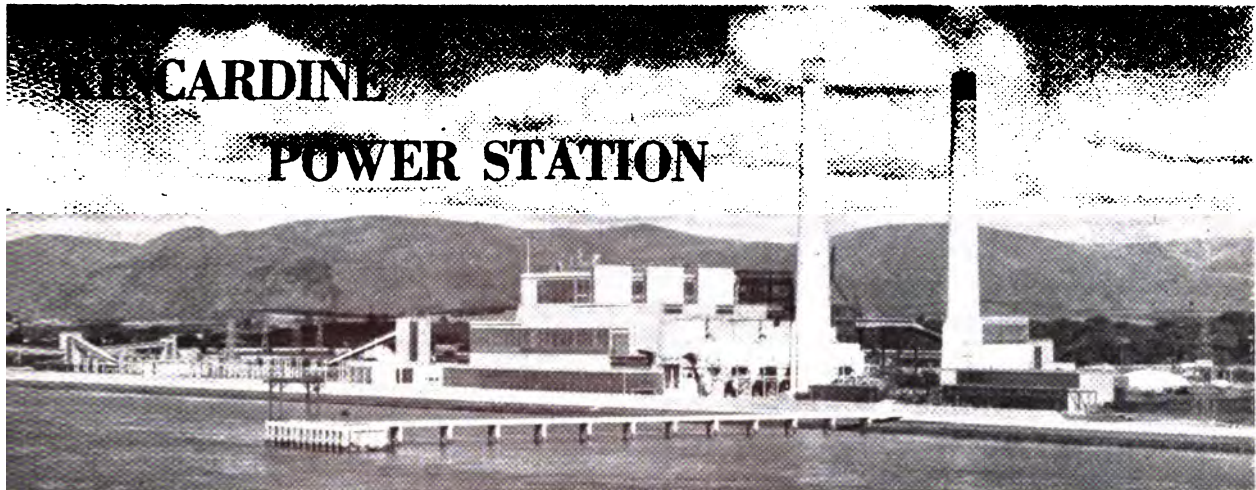
On estimating future demands, the argument is that it matters relatively little if too much plant installation is planned. Such over-provision of new plant could be countered by faster retirement of old plant and calculations have shown that heavy replacement of old plant would be only marginally uneconomic. Under-provision, within limits, can be met by retaining more old plant.

In the case of area boards, the situation is different. Shortage of capital over the years has left area boards with networks in many places seriously inadequate even for present loads. Any unexpected extra demand must be met by immediate capital investment.

This question of adequacy of distribution systems affects the control of supply industry investment by the Government as a method of affecting the economy of the country as a whole. If the Government eases the availability of capital, then the supply industry is one of the first to feel the effects of the change through demands for more supplies by factories and private dwellings. It is not possible to cut back the rate of capital investment for distribution suddenly in such circumstances, unless there is "some fat on the systems first." At present, Dr Edwards comments, "The bones of the distribution networks are almost showing through the skin."

Tariffs

On load factor improvement, Dr Edwards sounds a warning. Speaking on tariff design, he says: "It is important, despite the enthusiasm for low unit charges in retail tariffs, to ensure that they are kept slightly above marginal costs. It is necessary to avoid slipping into the position where increasing volume of business results in lower rather than higher surpluses."



NOTABLE occasion for the electricity supply industry in Scotland was celebrated yesterday when Her Majesty The Queen opened Kincardine power station. Estimated cost of the completed station, at £36½ million, ranks it as one of the largest engineering projects in Scotland in the last 15 years. Kincardine, with its ultimate installed capacity of 760 MW, will provide about half the city requirements in Scotland when it is completed in 1963. The station will make a major contribution to the N.E.B. programme, for its three 120 MW sets represent about one-third of the present installed system capacity and the two 200 MW sets under construction almost half the total new programme to 1966. Kincardine is more fortunate than most power stations in its siting. It has the sweep of the River Forth in its foreground, while the distant Ochil Hills help to soften the skyline.

on Construction

Light cladding of aluminium and glass with a brick portion has been used for main and ancillary buildings. In the turbine house, the first three sets are arranged transversely but, because of their length, the fourth and fifth 200 MW sets will be placed longitudinally. The well-planned station interior, with its varied colours, gives an immediate impression of lightness and airiness while maintaining a compact plant construction. The boiler house lies to the east of the turbine house, separated from it by an annexe containing feed pumps, motors, reserve tanks and boiler/turbine control rooms. Boiler and turbine controls for sets 1 and 2 are located in one room, with a separate control room for the third set. Eventually, a third control room will house the controls for sets 4 and 5. On the east side are the milling plant, precipitators, conveyors and ash-handling plant. On the west side of the turbine house are the switchgear compounds and transformer annexes and overlooking them the electrical control room. The station has three 120 MW sets in operation. Two of these were commissioned in December, 1958, and September, 1959, while the third was brought into service last month. The two 200 MW sets, with advanced steam turbine installations, will complete the station by 1963. The station site was reclaimed from the river in about 1950 and covers 150 acres; 137 acres are occupied by the station and its ancillary buildings, switchyards and

railway sidings. The site is below high-water level and an embankment provides protection against flooding. Additional protection is afforded by four 6,000 g.p.m. pumps, which start up automatically when the level in an underground surface-water reservoir rises unduly.

The site has a good access road linking with the main Kincardine-Alloa road and the fine river bridge. However, the station is designed to be supplied by rail-borne coal and its coal-handling plant can deal with 375 wagons/day, with an annual tonnage of 2,200,000. Facilities include two side-discharge tipplers for 24½-ton wagons and three filler pits for hopper-bottom wagons. The plant has provision for vibrating the wagons to dislodge coal and equipment for reducing dust nuisance. Duplicate 600 ton/hr conveyors, remotely controlled, take the coal to a central point from which it may either be distributed on the stock pile by 1,200 ton/hr conveyors or screened and crushed before being taken by one of two further 600 ton/hr duplicate conveyors to the boiler bunkers.

Boiler Plant

Three boilers supply the 120 MW sets, but No. 1 differs from Nos. 2 and 3 in being of International Combustion manufacture and in some different constructional features.

No. 1 boiler has five coal-pulverising mills of the suction type with rollers running on a grinding ring. Four of the mills will provide full load boiler capacity. They are driven by 200 h.p. 415 V constant speed motors and 275/77 h.p. 415 V Laurence Scott variable speed motors drive the exhausters fans which deliver the fuel to the boiler.

Nos. 2 and 3 boilers have four high-speed horizontal-spindle attrition pulverisers consisting of a combined mill and exhauster. The mills are driven by constant speed 600 h.p. Lancashire Dynamo motors, and three mills are capable of meeting full load.

All three boilers are designed for full load of 860 klb/hr with feed at 446°F superheater outlet at 1,600 lb/sq in. 1,010°F, and provide reheat to 1,005°F for 758 klb/hr steam. The boilers are of the natural circulation, water-tube type with radiant water-cooled combustion chambers designed to burn pulverised coal with an average calorific value of 9,400 B.Th.U./lb, and an ash content of up to 20%.

No. 1 boiler has the fuel fed to four tilting burners located at the corners of the combustion chamber and arranged for tangential firing. Superheater outlet temperature is controlled by spray-type desuperheaters between the primary and secondary sections of the superheater, while reheat outlet temperature is controlled by adjusting the burner tilt angle.

Above, a general view of the station from Kincardine Bridge over the River Forth

Nos. 2 and 3 boilers were built by John Brown Land Boilers. They differ from No. 1 in having the first section of the secondary superheater in the radiant zone at the top of the front wall, and in the form of platens suspended from the combustion chamber roof. A further section, in the convection zone, is followed by the primary superheater and reheater arranged in parallel gas paths before the economiser. These boilers have 16 burners in the front wall of the furnace.

All boilers have Lodge-Cottrell twin electrostatic precipitators preceded by Howden mechanical collectors. The precipitators are of the "catch pocket," horizontal flow type with rapping gear running at different speeds so that re-entrainment of dust particles is avoided. The precipitators have three banks of series electrodes energised at 50 kV d.c. and are designed to deal with up to 394,000 c.f.m. of gas at 280°F, with a precipitation efficiency of 99%.

Gases from these three boilers are exhausted to the first of two 400 ft-high brick chimneys having an internal diameter at the top of 24 ft. A second chimney will serve the 200 MW units.

Air is delivered to No. 1 boiler by two f.d. fans through two rotary regenerative heaters. Two outdoor induced-draught fans exhaust the gases from the precipitators to the chimney. The f.d. and i.d. fans are driven by Bruce Peebles induction motors, rated 495 h.p. and 1,017 h.p., respectively, through hydraulic couplings. On Nos. 2 and 3 boilers a similar arrangement is used. Both f.d. and i.d. fans are driven by constant speed motors through hydraulic couplings. The motors, built by AEI (Manchester), are rated 440 h.p. for the f.d. and 835 h.p. for the i.d. fans, respectively.

Feed and Circulating Water

The boiler feed system used for No. 1 boiler again differs slightly from that used on Nos. 2 and 3. Condensate from the main condensers is delivered by extraction pumps through two low-pressure heaters to a high-level deaerator. Mather and Platt booster feed pumps then raise the condensate pressure to 550 lb/sq in. before it enters three high-pressure heaters. Leaving these heaters at 435°F, the feed pressure is further raised to 1,950 lb/sq in. by the main boiler feed pumps. Mather and Platt supplied the three 50% duty booster and h.p. feed pumps and their motors. These pumps are designed to deliver 483

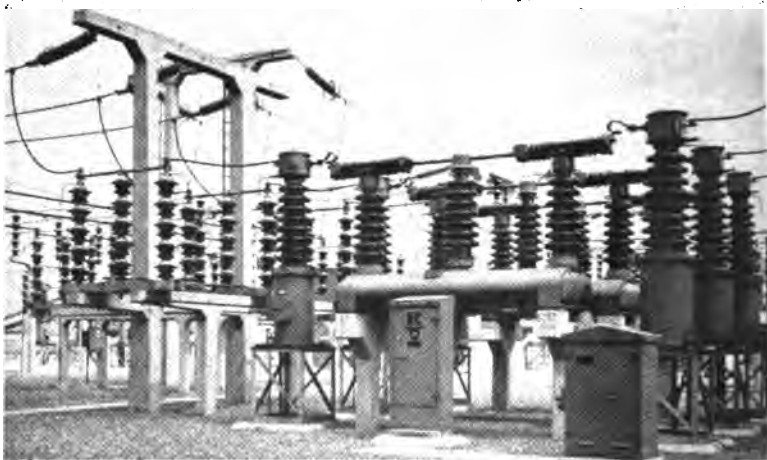
klb/hr. The four-chamber booster pumps are driven by 415 h.p. 6.6 kV two-pole double-squirrel-cage induction motors and the 11-chamber h.p. pumps, generating a head of 3,980 ft, are driven by 1,300 h.p. 6.6 kV solid squirrel-cage rotor water-cooled induction motors.

Boilers 2 and 3 have a single stage of h.p. feed pumping positioned before the high-pressure heaters. Six —50% duty, 10-stage pumps and motors supplied for this duty by Harland Engineering deliver 485 klb/hr at 260°F against a pressure of 2,005 lb/sq in. They are driven by 1,650 h.p. 6.6 kV water-cooled squirrel-cage motors.

Circulating water for the condensers is provided from the River Forth by four 65,000 g.p.m. vertical-spindle centrifugal pumps driven by Bruce Peebles 1,025 h.p. 6.6 kV motors. Because the River Forth at this point is tidal, cooling water is taken from a headwork 500 ft offshore near the river bed and discharged on the surface about half a mile upstream from an outfall on the bank.

Turbines

The three Parsons 120 MW turbo-generators are designed for steam conditions of 1,500 lb/sq in. 1,000°F, with reheat to 1,000°F at 365 lb/sq in. between the h.p. and i.p. sections. The turbines have three cylinders and three exhausts and run at 3,000 r.p.m. Reaction blading is used throughout, except for a two row impulse wheel at the h.p. inlet. Each turbine has three sets of i.p. blading, achieved by incorporating in an extension of the i.p. turbine low-pressure blading similar to the l.p. turbine.



▲ Fig. 2. A general view of the 132 kV switchgear compound. The switchgear installation for the first three 120 MW alternators consists of 15 air-blast circuit-breakers rated 3,500 MVA 132 kV. A further six breakers for 275 kV 7,500 MVA will be installed in an adjacent compound to serve the two 200 MW sets when they are completed



◀ Fig. 3. The five pulveriser mills for No. 1 boiler are of the Lopulco type and are driven by 200 h.p., 415 V motors. Four mills are capable of meeting boiler full load requirements

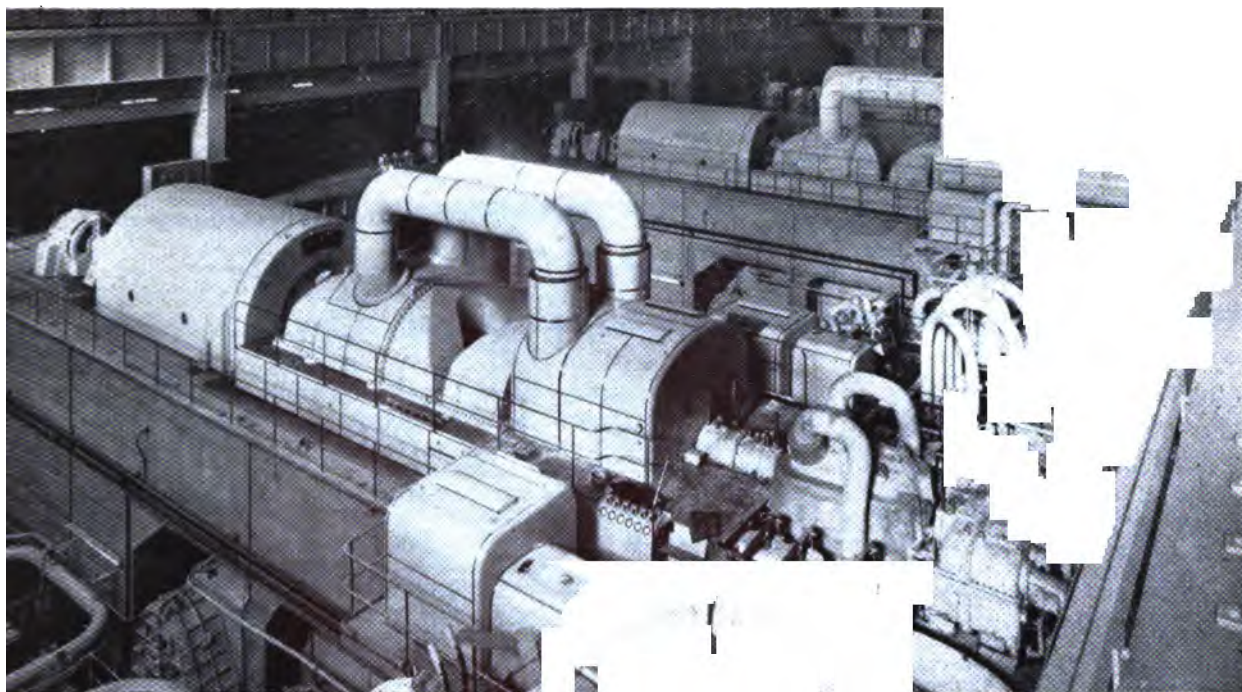


Fig. 4. Layout of the turbo-generator house showing the three 120 MW sets now in service. The 200 MW sets will be on the right

e shell construction is used for the h.p. and l.p. es and the h.p. cylinder is reversed to minimise thrust. allow for stored energy in the reheat system, ency control is supplemented by an auxiliary or, independent of the main governor and by pt and release valves. The intercept valves, normally close under control of the auxiliary governor at a erspeed. Steam from the reheat system and h.p. er is then passed by the release valves to atmosphere. aust steam, for heating feed water to 435°F, is l from the machines at six points. Each turbine has shell condenser producing a vacuum of 28.9 in Hg aving a total surface area of 70,000 sq ft designed cooling water circulation of 60,000 g.p.m. One shell s two-thirds of the steam derived from the i.p. and haust, while the other shell is coupled to a second st on the l.p. cylinder. Cathodic protection is used.

rators, Unit Transformers and Switchgear

generators are rated 120 MW at 0.85 p.f. 13.8 kV. -part construction has been adopted for the stator ilitate transport. An inner part, consisting of core indings, is housed in a separate outer casing con- g ducts for the hydrogen cooling system and the hydrogen coolers which are mounted on the top of the casing. Rotors are of the direct gas-cooled vith fans to circulate the hydrogen which is main- at a pressure of 15 lb/sq in.

h generator has a main and pilot exciter driven the rotor shaft through reduction gearing at 1,000 with excitation control by the AEI amplidyne l. The exciters are cooled by a filtered air circuit. bars in trunking link the three generators to their or generator transformers. These transformers were y Bruce Peebles and are rated 144 MVA 13.2/145 hey are of the OFW type and have 14 steps of on- ap changing giving a range of $\pm 10\%$.

generator transformers are linked to the 132 kV yard through oil-filled cables. The switchgear for st three sets comprises 15—132 kV air-blast circuit- rs built by AEI (Manchester) and rated 3,500 MVA. main plant auxiliaries are supplied by 3—11 MVA kV unit transformers made by Bonar Long. Other ries are energised from two 15 MVA 132/7 kV AEI r transformers and two 20 MVA starting trans-

formers, each having high-speed resistor transition on-load tap changers with 14-143 % steps.

The main auxiliary switchgear is of the English Electric 6.6 kV air-break type and is located with Whipp and Bourne 415 V switchboards in two annexes running the length of the turbine house.

The main electrical control room is located centrally in the turbine house annexe and houses controls and indication for all 132 kV circuit-breakers and 6.6 kV auxiliary feeders.

The consulting engineers for the station were Messrs Kennedy and Donkin in association with the civil engineers, Jas Williamson and Ptnrs. The architects were Robert Matthews and Johnson-Marshall.

PRINCIPAL CONTRACTORS

Main civil engineering	Holloway Bros. (London).
Structural steelwork	Redpath, Brown.
Lifts	Keighley Lifts.
Riverworks and site main drainage	Yorkshire Hennebique.
Brick chimney	P. C. Richardson.
Ash disposal and civil works	Mowlem (Scotland).
No. 1 boiler, milling and oil fuel lighting-up plant	International Combustion.
Nos. 2 and 3 boiler controls	John Brown Land Boilers.
Sootblowers	Ivor Power Specialty and Clyde Blowers.
Air heaters, i.d. and f.d. fans and mechanical collectors	Jas. Howden.
No. 1 boiler i.d. and f.d. fan motors and generator transformers	Bruce Peebles.
High-pressure valves and mountings	Hopkinsons.
Electrostatic precipitators	Lodge-Cottrell.
Automatic boiler controls	Bailey Meters and Controls.
Milling plant	Craven Bros.
Nos. 2 and 3 boilers, i.d. and f.d. fan motors, station transformers, and 132 kV switchgear	A.E.I. Ltd.
Turbo-generators, condensing plant, feed water heaters, air ejectors and heat exchangers	C. A. Parsons.
Deaerators	G. and J. Weir.
No. 1 boiler feed pump and motor	Mather and Platt.
Nos. 2 and 3 boiler feed pump and motor	Harland Engineering.
Circulating water pumps and motors	Drysdale.
Circulating water screening plant	J. Blakeborough.
Auxiliary pumps	Mirreles-Watson.
Coal handling plant	Simon-Carves.
Auxiliary electric motors, 6.6 kV switchgear	English Electric.
Ash handling plant	J. Thompson Industrial Construction.
Cabling and lighting	Ias. Scott.
Auxiliary motors	Lancashire Dynamo.
h.p. and l.p. steam and feed pipework and valves	Aiton.
Unit and starting transformers	Bonar Long.
Auxiliary transformers	Watford Electric and Bryce.
415 V auxiliary switchgear	Whipp and Bourne.
Contractor gear	M. and C. Switchgear.
Main generator connections	South Wales Switchgear.
Telephones	S.T.C. Communication Systems.

for the electrical trade

Luxury cooker at popular price

THOUGH inexpensive in comparison with "luxury" cookers, GEC's new "Treasure," at only £48, embodies a number of features usually associated with higher-priced models. It has an eye-level grill controlled by a three-heat rotary switch, an inner glass door on the oven and a separately heated plate-warming drawer. Two of the three plates are 7 in. "Superspeed" radiant rings of 2,100 W loading, each controlled by simmer switches, the other a new solid cast iron 1,000 W boiling plate of 5½ in. with three-heat control.

All five element control switches are placed in a line above the oven, on a neat panel which also carries the neon oven pilot light. This model is available with a time control for the 2,600 W oven, in which case the selecting dial is placed on the top right-hand corner of the splash plate. Finished in white or honeysuckle vitreous enamel, "Treasure" measures 36 in. in height to the hob and 54½ in. to the splash plate. It is 21½ in. wide and 22½ in. deep. Total loading, 10,035 W; D763, £48; time-controlled model, D765, £52. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*

B.C. holders for bi-pin fittings

IN order to ease the changeover to bi-pin fluorescent fittings where users still hold stocks of b.c. lamps, manufacturers of "Taskmaster" and "Litemaster" bi-pin fluorescent fittings have evolved a special b.c. lamp holder

which fits the existing channel. The problem was to produce a holder for b.c. connection within the same overall dimensions as the bi-pin. It has been solved by the use of a pedestal-type holder in which plunger contacts are incorporated into a piston mounting. This piston sinks into the pedestal to allow for tolerances in lamp length as well as for insertion of the cap, whilst its springs exert the pressure necessary to grip the lamp in position. Catches on the lamp are accommodated by entry slots, one of which embodies the cap-earthing contact. Lamps can be removed from these holders from one end. For double-lamp fittings, two holders are employed at each end, mounted on angled supports. List prices are 8s single holder and 18s double. *The Benjamin Electric, Brantwood Rd, Tottenham, N.17.*

Anti-frost pipe protector

A SMALL heating unit is available for preventing indoor water pipes from freezing. Known as "Negra," it comprises a 60 W heating unit housed in a black plastics case, flex connection and two-pin plug. It is intended for fixing to a vertical indoor water pipe and is said to protect 25 ft of pipe whilst outside temperatures are anything down to -10°C or -12°C. "Negra" is produced by the German manufacturers Graf and Ravisini. Distributors: *Barward Equipment Co., 5 New Quebec St, W.1.*

Stylish new iron

ELEGANCE is the keynote of Metway's new electric iron, "Ritzway." It is slimly fashioned, following the current trend, and has a newly designed handle. The iron embodies several interesting features, notably the soleplate of stainless steel. The earlier "Dualway" travelling iron also had a soleplate of

this material and the manufacturers have claimed on both occasions that it is a feature exclusive to their range. A thoughtful detail is in the flex connection; here a short rigid sleeve holds the cable horizontal to the table, but may be fixed to point in any direction to suit right-handed or left-handed users. An indentation in the toe enables the user to iron under buttons without tearing them off. "Ritzway" has a chromium plated top, the usual pilot light on the handle and is thermostatically controlled by a fabric selection wheel. It is said to be completely stable when rested back on its heel. Embedded type element has a 600 W rating. Price, £3 15s 10d, tax paid. *Metway Electrical Industries, Metway Wks, Canning St, Brighton 7.*

TRADE PUBLICATIONS

ZIRCONITE.—Leaflet on machinable refractory for 1,700°C plus from W. and C. Spicer Ltd., The Grange, Kingham, Oxon.

CIBA.—Technical Notes 213 for Sept., 1960, on Radio-frequency Heating, Part I. From the Technical Service Dept., CIBA (A.R.L.) Ltd., Duxford, Cambridge.

VERITYS.—Leaflet on Orbit, Junior, Mahar and Karachi fans from Veritys (Fans) Ltd., 64 Essex Rd, N.1.

REAL.—Abridged price list and catalogue of lighting equipment. Rowlands Electrical Accessories Ltd., REAL Wks, Hockley Hill, Birmingham.

TERYLENE.—Industrial buyer's guide, Part 6, Electrical and Miscellaneous Products. I.C.I. Ltd., Fibres Division, Hookstone Rd, Harrogate, Yorks.

EDMUNDSONS.—New lines supplement and revised price list of electrical appliances catalogue for 1960 by Edmundsons Electrical Wholesalers Ltd.

UNITY.—28-page brochure on heating units and central heating under Floorwarmth trade mark. Unity Heating Ltd., Chilworth Manor, Southampton.

BEULAH.—Eight-page technical leaflet on test equipment from Beulah Electronics, 138 Lewisham Way, New Cross, S.E.14.

NIMONIC.— "Developments in Nimonic Heat-resisting Sheet Alloys," a four-page leaflet. Henry Wiggin and Co., Wiggin St, Birmingham 16.

CIRCOMATIC.—15-page illustrated brochure on the new seam-welding machine giving details of welding for storage tank construction, also specification of machine, by Rockwell from Commercial Editorial Services, Creed La, E.C.4.

EMIDEC 1100.—Large technical brochure illustrating applications of electronic computers for commerce and industry. E.M.I. Electronics, Hayes, Middx.



▲ The new contemporary styled "Ritzway" iron, £3 15s 10d

◀ GEC's new cooker, "Treasure," the time-controlled Model D765 at £52

"Negra," a 60 W heater for preventing water-pipes from freezing



equipment for industry

capacity plug and socket

INSTANT low contact resistance is aimed for a new type of plug and now available in this country. The principle employed is that the plug are made up of a bundle of finely manufactured spring strips bent cylindrically. The total contact is thus theoretically the sum of the presented by the individual strips, thus being effectively spring-loaded. The even distribution of contact area thus be achieved than with a machined solid pin with a consequent elimination of hot spots. It is noted that although the plug-in force is negligible, the design ensures positive security against vibration. These make up the "ODU" range manufactured in Germany and cover a wide range of types up to a maximum carrying capacity of 30 A. *Arthur Matthews Ltd., 36 Victoria St.*

compact transistor valve voltmeter

INCORPORATING a compactly housed 6-stage transistorised amplifier and rectifier, the "ADVAC" VM77 valve voltmeter is suitable for a.c. and general voltage measurement. Readings can be made from 10 V to 300 V a.c. in 12 ranges including frequencies 10 c/s to 5 Mc/s. The anti-parallax scale is calibrated in r.m.s. and dB, support bipods are provided to facilitate viewing. Accuracy of measurement claimed for the instrument is $\pm 3\%$ f.s.d. between 10 and 2 Mc/s and ± 2 dB from 10 to 4.5 Mc/s, readings being close to r.m.s. even with an input having high harmonic content. *Advance Electronics Ltd., Roebuck Rd, Hainault, Essex.*

thermistor bridge thermometer

HERMISTOR bridge circuit is used in the construction of an industrial thermometer capable of giving accurate and accurate temperature readings. Although the standard probe is designed for surface temperature measurement it can also be immersed for the temperature measurement of many liquids. Alternative probes are available for gas temperature measurement. The instrument is the "MIP Thermometer" of which there are two types, one being for a temperature range -40°C to 10°C , the other for 10°C to 110°C . An anti-parallax scale is incorporated and the time taken to obtain a reading is approximately 15 sec.

Powered by a Reubens/Mallory cell, the compact, lightweight and rugged construction of this instrument should make it suitable for a wide range of applications, particularly in metal-rolling mills, air-conditioning systems and branches of the chemical industry. *Measuring Instruments (Pullin) Ltd., Electrin Wks, Winchester St, Acton, W.3.*

Miniature mains plug and socket

A 3-PIN 1 A miniature mains plug, type L.1436/P, has been introduced having overall dimensions 1.031 in. by 0.703 in. by 0.875 in. The virtually unbreakable body is of black nylon with shrouded silver-plated pins, a notable feature being the transparent nylon cover facilitating terminal inspection. Cable sizes of up to $\frac{1}{4}$ in. dia can be accommodated by the grip and the plug is designed to disengage without damage should the cable lead be accidentally jerked. Supplied with the plug is a 1 A socket-outlet, L.1436/S. This is for panel mounting by means of a single lock-nut and has a fully shrouded phenolic body, the sockets being of silver-plated beryllium copper. *Belling & Lee, Great Cambridge Rd, Enfield, Middx.*

Shaded-pole small motor range

SUITABLE for powering light equipment such as fan heaters, office machines and cine-projectors, a range of shaded-pole motors has been announced comprising 12 models. These give output torques from 1.24 oz in. to 7.2 oz in.

continuous or intermittent rating, for supply voltages up to 250 V and frequencies 50 or 60 c/s. Known as "P" type motors, skeleton frame construction is employed and dimensions are standardised to the extent that four armature core lengths and two shaft diameters cover the entire range. *Limit Engineering Group Ltd., 64 Essex Rd, Islington, N.1.*

Corrosive liquid immersion heater

A CONVENIENT method of electrically heating corrosive or semi-corrosive chemical solutions is provided by the "Red-Rod" immersion heater. This has its heating element sheathed in quartz which is immune from attack from most liquids liable to be encountered with the exception of concentrated caustic alkali, hydrofluoric and phosphoric acids. The quartz sheath will withstand violent thermal shock and will thus remain undamaged even if plunged at red heat into cold water. The heater unit is available in two diameters ($\frac{1}{2}$ in. average), lengths varying from 10 in. to 14 in. at ratings 300, 400 and 500 W. Standard voltages are 100 to 120 V, 200 to 220 V and 230 to 250 V. The device should be particularly useful for chemical laboratory work. *Electrothermal Engineering Ltd., 270 Neville Rd, E.7.*

Unit construction multi-pole m.c.b.'s

CONSISTING of double- and triple-pole units, a range of miniature circuit-breakers is available for currents from 5 A to 60 A at 440 V a.c. and 250 V d.c. These extend and, in fact, are built up from the original "Midget" range of single pole units. Tripping mechanisms are linked internally and simultaneous tripping is ensured by utilising a specially shaped contact arm. The operating mechanisms are linked externally. These units should find application in the protection of wiring installations in shops, offices and factories. *The M.C.B. Co. (Manchester) Ltd., Lupus Wks, Oxford Rd, Altrincham, Cheshire.*

Red-Rod immersion heater with quartz sheathed element for corrosive liquids



Pullin thermistor bridge industrial thermometer



Typical shaded pole motor in the new range developed by Limit Engineering for small fan and similar drives



Unit construction multi-pole m.c.b. by the M.C.B. Co

Low-priced test meter

A MULTI-RANGE test meter claimed to have good accuracy, high-quality construction and durability is available in two models with the more sensitive version priced at £6 10s. This meter has seven d.c. and four a.c. voltage ranges from 0.5 V to 1 kV, four resistance ranges up to 20 megohm and four d.c. ranges from 0.1 to 250 mA. Accuracy on the a.c. ranges is claimed as $\pm 3\%$ and $\pm 2\%$ on the d.c. ranges. The meter measures $5\frac{1}{2}$ in. by $3\frac{1}{4}$ in. by $2\frac{1}{4}$ in. and is of foreign manufacture. The less sensitive model is slightly smaller, has five a.c. and d.c. voltage ranges, two resistance ranges and three d.c. ranges up to 250 mA. Sensitivity is claimed as 2,000 ohms per volt. *Household Electrix Ltd., 47 High St, Kingston-on-Thames, Surrey.*

Polythene tape

IN the note on Rotunda tape, which was published in "Equipment for Industry" in the ELECTRICAL TIMES of 11 Aug., some confusion occurred regarding the properties of the various tapes described. Polythene-based self-amalgamating tape, with which our note was mainly concerned, is a mixture of polythene and self-amalgamating rubber. It is claimed to have excellent electrical properties, and to be resistant to ozone, as well as being extensible. The tape has good resistance to water vapour, corrosive atmospheres, dilute acids and alkalis, but is attacked and softened by oils, greases, fats and certain solvents.

No special claims are made for the mechanical strength of this tape, and the manufacturers recommend that in use as an electrical insulating tape it should be finished with an outer wrapping of p.v.c. plastic adhesive tape. This gives the desired mechanical strength and some measure of protection against attack by acids, oils and solvents. The general properties of the polythene-based self-amalgamating tape are given in the earlier part of our August note. *Rotunda Ltd, Denton, Manchester.*

Motor timer unit

INTRODUCED for the control of industrial processes, space heating and domestic appliances, the HR timer unit incorporates a single-phase synchronous motor which drives the switching contacts. The timer can open or close as many as 12 external electrical circuits in timed sequence, the particular sequence being specified in advance and set by the makers. A knob on the dial is turned until a pointer indicates the total timing period required. The pointer returns to zero during the timing period and the motor is then cut out. The standard model of this unit is fitted with two changeover snap-action switches having a capacity of 5 A at 230 V a.c. for supply voltages 400 V to 440 V or 200 V to 250 V at 50 c/s. Timing ranges between 0.30 sec and 0.7 days can be provided as required. The timer body is $3\frac{1}{4}$ in. diameter and is for panel mounting. *Electrical Remote*

Control Co. Ltd., The Fairway, Bush Fair, Harlow, Essex.

Cheaper time keeping

PARAMOUNT claims for the recently announced "Minipulse" clock system are the compactness of the master and slave units and their relatively low cost. The low price of the units is expected to make them competitive with foreign built time keeping systems without sacrifice either of quality or performance. The system uses a movement which is claimed to be unique, operating on a pulse system. One pulse per minute is transmitted to each of the slave clocks which may number up to 50 with the basic circuitry. If, however, additional operating relays are included the number

of dials may be increased. The small movement required for the slave units has two advantages, it is sufficiently small to be mounted behind the clock bezel without the need to cut recesses in the mounting wall, and use of what is termed a "reverse polarity" control eliminates ratchets and pawls, so ensuring inaudible operation.

The master clock is relatively small, and is compensated for temperature variations. A wide selection of slave dials are available and special clocks for executives' rooms and other important locations are custom built. In conjunction with the "Minipulse" system, a programme unit can be used to operate bells and other warning or timing signals. *Minipulse Clocks Ltd., Clutha Hse, 10 Storey's Gate, S.W.1.*

TIME AND INSULATION

Mr C. G. Garton's Address

MUCH more is demanded of insulation in many electronic applications than was required in earlier uses for electrical power equipment. This is so especially with regard to temperature and reliability. This theme was developed by the chairman of the IEE Measurement and Control section, Mr C. G. Garton, M.I.E.E. (ERA), in his inaugural address delivered on Tuesday.

New requirements for working temperature varying from the extreme cold that may be experienced in a satellite to the high temperature of nuclear reactors. In the latter field, pump motors have already been required to operate with windings immersed in a liquid at 450°C, while temperatures of 1,500°C are envisaged.

Another relevant factor in considering insulation today is the extreme complexity of some electronic apparatus. The number of components in a large computer may be of the order of a million, so if the probability of failure in any given component were as great as once in 20 years, and failures occurred at random over this period, operation of the computer would be interrupted every few minutes.

To meet this situation, the insulation engineer cannot rely on conventional tests and knowledge of insulation behaviour which have served for less stringent requirements. It is important that he should develop ways of thinking about insulation which give an intuitive feeling for the behaviour of matter at temperatures and over long periods which are outside the range of direct human experience. For example, the h.v. capacitors in submarine telephone cable equipment require an average life of about 10,000 years in order that no single one shall fail within the 30 years' life of the cable. On the other hand, a process of deterioration which may take thousands of years to complete at the temperature of sea water may take place

in a few seconds if the temperature is raised to 400°C.

Rate Processes

Mr Garton suggests that there is a unifying concept which makes it easy to understand the great dependence of insulation properties on temperature. This is the concept of the "rate process." He approaches it by considering why chemical or physical processes, which it is known will reach completion after a longer or shorter time, do not go to completion instantly. The reason is that atoms or molecules in any system which is not in an extremely rapid state of change, occupy the position which they do because they have found at least temporary positions of minimum energy in the structure.

The atoms or molecules cannot leave these positions until by some means they acquire sufficient energy to pass over an energy barrier to a new position of lower energy than the first one. Since most external causes of energy change such as an electric field or moderate mechanical stress cannot supply anything like this amount of energy to an individual molecule, the only occasion on which the molecule can make the transition described above is when it receives by chance an altogether exceptional proportion of the random thermal agitation which is distributed throughout the system.

This idea can be expressed mathematically by saying that the rate of change in a simple rate process is governed by a characteristic time.

$$\tau_0 = \tau_0 \exp(W/kT)$$

where τ_0 is constant, W is the energy required to enable a molecule to make a transition, and kT is the thermal energy which at room temperature is about 0.025 eV. This simple equation underlies nearly all the changes, electrical, mechanical and chemical to which insulation is subject.

News of the Week

MAJOR WAGE RATE CHANGES FOR ELECTRICIANS

ONE shilling per hour extra for journeymen electricians applicable from 1 Jan. next, revised overtime rates, and a standstill agreement on wage rates for 2½ years dependent on not more than five points movement in the cost of living index, are outstanding features of a new agreement between the NFEA and the ETU announced on Tuesday.

Under the new agreement, the wage rates for journeymen electricians in the contracting industry will be: London, 6s 6½d/hr; Provinces, 6s 2d/hr; Mersey area, 6s 5d/hr. There are to be corresponding adjustments for other classes of employee. These will be the new inclusive hourly rates of pay.

The NFEA and the ETU have agreed that the rates specified are to remain in operation for a period of 2½ years, except that if the cost of living figure changes more than five points from its value at Dec., 1960, the NFEA may apply for a change in rates if the figure goes down, or the ETU may apply if the figure goes up.

As from 1 Jan., 1961, all payments made on any job throughout the country under clause 12 of the National Agreement ("work under abnormal conditions") or through NJIC or area JIC awards, or through site agreements, will cease to operate, with only two exceptions: the provisions of clause 12 relating to collieries and stationary accumulators.

Overtime rates as from 1 Jan., 1961, are to be changed to the following: For the first two hours in excess of normal, time-and-one-third. For any subsequent overtime time-and-a-half. After four hours the rate for the next two hours will be time-and-two-thirds. Thereafter and until the beginning of the following day shift, double-time.

Overtime for Saturday work in respect of 5½-day operatives will be: the first two hours after normal morning work, time-and-one-third; thereafter until midnight, time-and-a-half. In respect of five-day operatives, the first two hours of Saturday work, time-and-one-third; and thereafter time-and-a-half until midnight. The part of Clause 8 of the National Working Rules which states that payment of more than the standard

rate is not prejudiced by that section of the agreement, is altered by having words added that make it clear that such payment "is at the sole discretion of the employer."

This agreement, of course, applies to the 42-hour week to be worked in the electrical contracting industry from 1 Nov. next. That agreement pledged both NFEA and ETU to co-operate in securing full utilisation of hours of work and achievement of maximum output and elimination of time wasting.

South Scotland Board's new charges

DETAILS of cuts in their off-peak tariffs (to which we referred on 22 Sept.) have now been given by the South of Scotland Electricity Board. For medium voltage supplies the reduction is of 0.05d p.u., making each of the three rates 0.75d, 0.8d and 0.85d. For h.v. supplies a reduction of 0.04d p.u. brings the rates to 0.73d, 0.78d and 0.83d, respectively. The afternoon restricted hours are also amended for tariffs 1 and 2.

These changes apply from 15 Nov. as do increases in the m.d. tariffs just announced by the Board. Under these, each step of the m.d. charge is raised 3s and for h.v. supplies the unit charges are increased to 0.9d, 0.8d and 0.7d; and for m.v. supplies, 0.92d, 0.82d and 0.72d, respectively, but the fuel adjustment rate goes to 90s and, in effect, will reduce the charges (see page 546).

RECEIVER FOR VACTRIC

A RECEIVER and manager has been appointed for Vactric Ltd.—less than three weeks after the company revealed a net loss of over £122,000 and serious financial difficulties. Under a power contained in a mortgage debenture the firm's bankers have appointed Mr J. W. Margetts, of Peat, Marwick, Mitchell and Co. as receiver and manager. The latter understands that two subsidiaries, Vactric (Control Equipment) Ltd. and Vactric (Precision Tools) Ltd., which are not directly concerned with the home-

appliance trade, are operating on a profitable basis and it is anticipated that they will continue to trade normally.

Vactric Ltd., as manufacturers of vacuum cleaners and washing machines, is probably the largest firm operating a direct-sales organisation for such goods. This side of the business was responsible for the loss sustained in the year ended 31 March last—before the imposition of h.p. restrictions. Since that time the situation has worsened, with substantial stocks accumulating and the group's financial resources strained to the limit, we revealed on 22 Sept.

Capital of Vactric consists of £300,000 in Cumulative Preference shares, £300,000 in Ordinary, and £200,000 in non-voting shares. It is understood that Mr W. C. Pegley, chairman and managing director, holds over 50% of the Ordinary voting shares. A year ago he rejected a takeover bid of 55s a share from Arusha Industries Ltd.

B.E.P.C. 1962

THE 1962 British Electrical Power Convention will be held at Brighton in the week commencing Monday, 4 June, it was decided at last week's meeting.

New Retailers' Organisation to Quiz Manufacturers

FIRST action by a new organisation of electrical retailers will be to ask manufacturers for clear-cut statements on their individual price maintenance policies. The group, known as the Electrical Retailers' Organisation, is in favour of price maintenance and takes the view that the effectiveness of fixed prices is destroyed by offering gifts with each sale.

Initiated four months ago at the request of a number of retailers throughout the country, the organisation intends to build up membership as quickly as possible to a point where registration as a national association will be allowed.

Active in the promotion of ERO is Mr H. A. Curtis, secretary of the organisation and a member of its council, who was associated with the

formation of the Radio and Television Retailers' Association some years ago. Other members of the council are Messrs C. R. Spouge, of Lincoln (chairman); R. C. Gilbert, High Wycombe; G. Michelson, Sunderland; D. Sonley, Sunderland; W. R. Stone, Hoddesdon; and S. Fishlock, Rugby. The number of retailers in ERO is not revealed.

Kenwood in Midlands

NEW premises have just been completed for the Kenwood group of companies at Berry Hill, Droitwich. It comprises a 3,600 sq ft office block, a 6,000 sq ft warehouse and service workshop and includes a demonstration theatre for staff training and a permanent showroom. The warehouse will be the national distribution centre for Kenwood products.

"Which?" questions Electric Blanket Safety

DETAILED research into the causes of accidents with electric blankets is called for in the October issue of *Which?*—magazine of Consumers Association Ltd. Tests by the Association on 11 popular single-bed models of well-known brands showed that only seven models complied with the BS, although some of those that failed tests were kite-marked.

If recent recommendations of the New Zealand authorities for safety in electric blankets had been used as criteria, or the existing USA regulations, none of the blankets tested would have been passed as safe.

"Which?" criticises that "The whole situation is unsatisfactory because we have too little information. Too little seems to be known about the precise causes of fires from electric blankets in this country."

One general remark in the survey is that the safety of an electric blanket depends much on the way in which it is used. Clear instructions, it is suggested, should be given by the manufacturer, and followed exactly by the user. Such instructions should include warnings not to switch on if the blanket is wet, not to use the blanket folded and to examine it frequently for signs of wear. (Some of these points are covered by BS requirements for instructions with blankets.)

Which? estimates that there are over 200 models of electric blankets to choose from made by over 40 manufacturers. For this reason it does not suggest a best buy or the like on the basis of its

tests. It reports testing two makes of blankets which failed certain electrical safety tests; but these models have been withdrawn so they are not reported on in full.

Which? publishes an electrical glossary as part of its blankets report, defining the common units and saying briefly what a thermostat is. It is noticeable that the glossary seems to ignore the existence of the 13 amp fused plug, saying that for a 4 amp load a 5 amp plug would be used.

Commenting on the *Which?* survey, BEAMA says that the UK is one of the "very few" in the world which has a standard relating to electric blankets. They note that the Molony Committee said the existing BS represented as much protection in design as a technically difficult situation permitted. The standard is under review at present, but in its existing form it is stringent.

G.E.C. cuts t.v. production

LATEST firm to cut television set production is the General Electric Co. Over 200 employees at Coventry have been taken off the production lines and as many as possible transferred to other work, but the GEC fears that a considerable proportion of redundancy is inevitable. The step has been taken after full consultation with the trade unions concerned. GEC state that this cut in production is necessary because of the effect of the credit squeeze on TV sales.

House with heat pump

A SURPRISING claim is made for a new "package" house equipped with a heat pump, being erected at Canterbury. The heat pump cools a larder and supplies space heating and hot water for, it is said, 14s a week. Warm air pumped from the larder and a supplementary 3 kW element provide the heat. Designers of the house are Jonmil Building Developments Ltd. Price of a 1,200 sq ft house, without land—£3,350.

Enters industrial refrigeration here

JOHN THOMPSON (Wolverhampton) Ltd., already established in industrial refrigeration in South Africa, is entering this field in the UK. Directors have decided to form a refrigeration division based on the main group of factories at Wolverhampton.

Specialised refrigeration equipment of all kinds, other than domestic and retail trade equipment, will be designed and manufactured by the new division. Large scale industrial air-conditioning is included in the division's scope. Refrigeration projects for the chemical, oil, food storage and transport and ice-making industries will also be undertaken.

OFFICIAL PUBLICATIONS

Advisory Council on Scientific Affairs, Report of. HMSO. 1s 9d (see page 574).

NCB Specification 195: 30 A medium voltage flameproof air-break electrically operated gate-end box. 2s.

Factories (Cleanliness of Walls and Ceilings) Order, 1960. SI 1794. HMSO. 3d (see page 575).

Problems of Progress in Industry, No. 9. Automation and Skill. DSIR Report. HMSO. 3s 6d.

BS 495. Lamp Caps and Lampholders for double-capped tubular lamps. 3s.

Pressed Steel expansion

A MAJOR production plant for Pressed Steel Co. Ltd., at Stratton St. Margaret, near Swindon, is to be built by Holland & Hannen and Cubitts (Great Britain) Ltd. under a £3½ million contract signed last week. To be completed in 12 months, the plant marks the third stage of development on the site. The Pressed Steel Co. also announced last Friday that the capital of Auster Aircraft had been acquired and the firm is to make a new range of executive and light aircraft for home and export.

Canada puts 15% duty on steam generating sets

CANADA has now imposed an import duty on steam turbo-generators. Such imports from Britain and the Commonwealth will carry a 15% duty—for certain equipment in the sets a 10%

duty will apply. Formerly they were imported duty-free. The new tariff rate applying to certain other countries, including the USA, is raised to 22½%. The latter figure applies to such imports from Switzerland—Britain's chief competitor there—so that the change, in effect, reduces the margin of preference between the two countries from 20% (the old tariff rate) to 7½%.

These changes result from a new ruling by the Revenue Department which maintains that they are "of a class or kind made in Canada." But the change does not affect Canadian orders for such plant placed before 27 Sept. last. Until recently there were no large manufacturers of steam turbo-generators in Canada, but in the past few years such firms as English Electric, Canadian General Electric and Canadian Westinghouse have established plants there to undertake manufacturing work and the size of sets is increasing.



his luminous ceiling lighting installation in the boardroom of the Midland Employers' Mutual Association, Birmingham, is the first in this country to utilise the new p.v.c. louvered tile, "Circlgrid," now being made and marketed here by Harris & Sheldon Electrical Ltd. Two panels each carry 42 "Circlgrid" tiles. Twenty-four 4 ft. 40 W white lamps in batten fittings give an average illumination of 35 lumens/sq. ft. on the table

Hydro-electric scheme for Glen Nevis

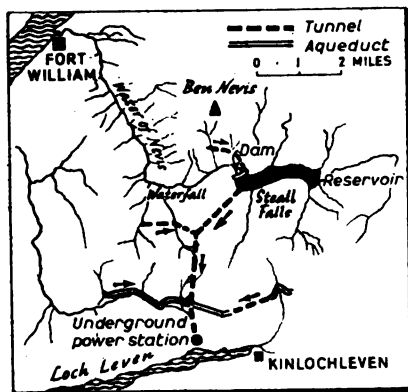
A £4.2 million scheme for utilising the water power resources of Glen Nevis, to provide an annual output of 82 million units, is proposed by the North of Scotland Hydro-Electric Board in its construction scheme, No. 37, published last Friday. Apart from extending the present public road, there would be no works in the main and best known part of Glen Nevis under the plan, which represents the result of careful investigation and of discussion with individuals and bodies interested. The present access to the Ben Nevis peak would not be affected in any way.

In the upper and remoter part of the Glen an arch type dam, 240 ft high, would be built across the head of a gorge, some 2½ miles above Polldubh, to form a new loch 1½ miles long. From this loch water would be led by tunnel to an underground power station, capacity about 25 MW, close to the shore of Loch Leven and which would discharge into the loch some two miles west of Kinlochleven. The plant would operate under a maximum head of 940 ft—one of the highest in the country.

Water would also be collected for use in the scheme by piped aqueducts and tunnels from some streams on the south and north sides of Glen Nevis, on the north side of Loch Leven and from the upper tributaries of the River Kiachnish which flows to Loch Linnhe. After passing through a small generating set, compensation water would be released at the end of the gorge below the dam.

Electricity generated at the underground power station on Loch Levenside would be fed into the Highland grid by a short transmission line to an existing substation behind Fort William. Emphasising that Ben Nevis would not be affected by the scheme, the Board state that the flow down the waterfall at Polldubh would be greater than the natural flow there during the summer, but the height of the Falls of Steall, in upper Nevis valley, would be halved when the reservoir is full.

Although the National Trust for Scotland has stated that they do not feel the published version of this project gives sufficient information for a balanced judgment of its merits, Mr Gerald



Nabarro, M.P., has already given notice that he will object to it. He considers the cost of the scheme—£168/kW—"is unusually expensive and extravagant."

Reappraisal suggested for N. Scotland

A COMPLETE inquiry and reappraisal of the functions of the North of Scotland Hydro-Electric Board in the light of the radical changes in the national fuel situation, brought about by the surplus of coal and oil, is being sought by the executive committee of the Scottish Landowners' Federation. At their meeting last week the committee decided to recommend that until there had been such a review, all schemes still under survey should be suspended—including, the Glen Nevis scheme (see this page).

The committee said they recognised the achievements of the Hydro-Electric Board in circumstances not originally envisaged and they believed the Board had completed its task. They suggest that as an alternative the further power supplies for the South of Scotland area should be generated in that region itself, with the Hydro Board concentrating on completing the connection of outlying districts to its system. If necessary, supplies be imported from the south, or small plants established.

1200 MW station planned in S. Scotland

A NEW 1,200 MW steam power station "somewhere in the Lothians" is being planned by the South of Scotland Electricity Board. Further news on the plans—already referred to in these pages—was given last week by Mr William Hutton, deputy chairman of the Board. Nineteen possible sites are now under consideration, but it was intended that the station should draw its coal from the developing Lothians coalfields and would be situated as near the pits as possible. Ultimate capacity of the station would depend upon the amount of coal which the National Coal Board could make available.

The S. Scotland Board are also negotiating with the NCB for the acquisition of the latter's generating stations. As part of the replacement policy which would follow this takeover, the S. Scotland Board are now exploring the possibility of a slurry-burning station in Fife, as part of the post-1966 programme. "We are encouraged in it by the striking success of the Barony slurry-burning station in Ayrshire. The Fife

project will use about 250,000 tons of slurry a year—almost all the output of slurry from the area—and have a capacity of 60 MW," Mr Hutton stated.

G.E.C.—Simon-Carves

A PRIVATE company with the title GEC—Simon-Carves Atomic Energy Co. Ltd. has just been formed to take over and give formal standing to the GEC—Simon-Carves Atomic Energy Group which has been a loosely knit organisation. The new company has an initial capital of £50,000 in 30,000 "A" Ordinary and 20,000 "B" Ordinary £1 shares.

Floods—but no breakdowns

ALTHOUGH some parts of southern England had their worst floods last week-end since the 1953 east coast havoc, the electricity boards supplying the areas have come out of the troubles relatively unscathed. In Lincolnshire, one of the worst affected areas, for instance, there were no interruptions on the h.v. system of the East Midlands Electricity Board and the staff of the Lincolnshire sub-area have been able to cope without seeking outside help. At Horncastle it was necessary to change cut-outs and meter linkage in about 150 premises.

In Devon, the South Western Electricity Board also maintained supplies and in Exmouth between 700 and 800 premises were dealt with over the week-end, with the aid of additional workmen drafted in from outside the district. Again, it was a question of putting the installations in order after water had been pumped out, a situation which applied in many other trouble spots.

LARGE CONTRACTS

JOHNSON AND PHILLIPS are to supply two 13-panel and two 11-panel 250 MVA, 6.6 kV compound-filled metalclad switchboards for Richborough power stations. They are for control of the auxiliaries and will be equipped with the new J and P type PDB oil arc-control circuit-breakers. All feeder c.b.'s will be provided with d.c. solenoid mechanisms arranged for remote control.

BOWATERS Engineering and Development Inc., of Calhoun, Tennessee, has ordered from AEI (Canada) Ltd. seven single-reduction gearboxes and spares worth £70,000, for use in a wood-pulp mill in New Zealand. The gearboxes, each of which will transmit 6,325 h.p.,

will be manufactured at Rugby by AEI Heavy Plant Division. Six boxes will have a speed reduction of 1,000/250 r.p.m. and the seventh, 1,000/300 r.p.m. The reductions of the replacement rotating parts will be from 1,000 to 375, 333 and 250 r.p.m., respectively. The equipment has been ordered on behalf of the Tasman Pulp and Paper Co. Ltd., Kawerau, NZ.

A CONTRACT worth £153,000 for the construction of two reinforced concrete brick-lined chimneys at Blyth "B" power station has been awarded to Mitchell Construction Co. Ltd. The chimneys will each be 550 ft high, one of 27 ft internal dia and the other 30 ft at the top.

RURAL ELECTRIFICATION AIMS

Eastern Board seeks completion in 5 years

COMPLETE electrification of the rural areas of the Eastern Electricity Board is the aim of "Operation Round-up," a five-year scheme launched last week by Board chairman Mr. H. V. Pugh. The remaining 15% of farms, together with other rural premises, he hopes to get connected within the next five years at no higher capital cost to the new consumers than their predecessors have paid.

Because the premises remaining to be connected are very scattered and remote, Mr Pugh estimates that the cost of bringing electricity to them will be two or three times as much as for consumers connected during the five years past. In that period the number of farms connected by the Eastern EB has risen from 18,330 (March, 1955) to 26,110 (March, 1960). At the end of August it was estimated by the Board that about 5,000 farms remained to be connected. Mr Pugh thinks that all buildings except those with only a short life remaining and isolated week-end cottages will be provided with a supply.

Despite the increasing remoteness of the premises to be connected, the standard connection charges introduced by the EEB in 1958 will be applied. Consumers in small domestic premises will pay about £1 1s/quarter for seven years as a capital contribution and those charges extend up to £13 15s/quarter

for the same period for connection of a 500-acre farm. These charges were fixed on the basis of the rural connection programme for the three years 1958 to 1961, which took the EEB from 74.2% of farms to 85%. Estimated costs were pooled and standard connection charges fixed to give the overall return required.

Extension of these standard charges to the more remote consumers is a move by the Board to encourage fullest possible support for connection schemes. There will be a drive for 100% acceptance of schemes by potential consumers. If there is a refusal to take a supply by one member of a group, the scheme for the whole group may be scrapped.

The Board's managers have instructions to "plan and construct the lines in a way which will keep the ultimate capital cost to the minimum and at the same time ensure that in each year the maximum number of consumers is connected out of available capital."

An important element in deciding success or failure of the scheme will be readiness of landowners and farmers to grant wayleaves for lines over their land. "The community as a whole is trying to do its best for the outlying country folk," said Mr Pugh. "They are entitled to look for the support which will enable the work to go forward at least cost."

Appeal on "know-how" tax case

THE High Court ruling allowing appeals by Rolls-Royce Ltd. against tax assessments arising from the sale of technical knowledge (reported in our 2 June issue) is to be challenged by the Inland Revenue. Rolls-Royce have maintained that they carried out considerable research and development work on aircraft engines and, subsequently, made a series of agreements with many countries under which the firm received lump sum payments for providing the countries with the necessary drawings and information to make their own engines. The action concerned assessments in the firm's profits amounting to over £15 million for the years 1948-55. The company contended that their store of technical "know-how" was a fixed capital asset which was disposed of to the countries. Mr Justice Pennycuik upheld that appeal, but the Inland Revenue are to ask the Court of Appeal to reverse that decision.

Purchasing in Europe

THAT is the title of a 108-page publication just issued by the European Federation of Purchasing which contains all the papers given at the Federation's second conference in Holland last April. The papers are given in three languages, English, French and German, being in full in their original language, with summaries in the other two. Copies are available from the Federation, 146a Queen Victoria St, E.C.4, price 5s.

Socialist Views on Nationalised Industries

CONNECTIONS between nationalised industries and the "private sector" of industry are discussed in a new publication of the Fabian Society, *Nationalised Industries in a Mixed Economy*, by Mr J. Hughes. The author considers a wide range of topics, including Government intervention in price policy and what he considers the theoretically mistaken (though possibly politically acceptable) practice of pricing to break even on revenue account, rather than achieve a substantial surplus. The author is strongly critical of nationalised industry generating capital gains for private shareholders, as he puts it. He quotes orders from the CEBG to the electrical plant manufacturing industry as an example of this. The pamphlet is published by the Fabian Society, price 4s.

New Redditch H.Q.

NEW headquarters and depot for the Redditch and Bromsgrove district of the Midlands Electricity Board were inaugurated last week. The new premises, in Windsor Rd, Redditch, include a two-storey office block, stores and workshop block, and garage, all with electric floor-warming, with a total heating load of 500 kW. A 66/11 kV substation is under construction. At Feckenham, nearby, the CEBG are establishing a new grid point on the supergrid, and the MEB are building a £300,000 substation. In the Redditch and Bromsgrove district the percentage of farms connected is now 96.5%—a high figure.

GOVERNMENT SCIENTIFIC POLICY

WHETHER the scientific research effort in the UK is spread over the various branches of science in the most rewarding way is discussed at length in the annual report of the Government's Advisory Council on Scientific Policy. No simple answer is put forward, but the Council warn that it is becoming increasingly clear that the "growing points" of science are found most frequently in areas lying between the traditional subjects. In universities, this situation needs to be met by a greater willingness of established departments to accept studies which lie partly outside their traditional field.

Looking at research and development effort overall, the Council estimates that Government provides 66.9% of the finance, but that most of this (49% of all expenditure) comes from the defence departments. Private industry contributes most of the balance, no less than 28.5% of the whole. On a basis of proportion of gross national product spent, the UK is now almost up with the USA. America spent £3,971 million on research and development in 1958, 2.74% of the gross national product; while the UK spending, at £478 million, represented 2.35% of gross national

product. It is reckoned that the proportion of spending attributable to defence was somewhat greater on the part of the USA.

The report records that during 1959, universities awarded 357 honours degrees in electrical engineering, 13 more than in the previous year. These figures do not include diplomas and pass degrees.



Mr D. H. Kendon (second left), MANWEB chairman, discusses a relevant point with Mr D. G. Dodds (left) in front of a Simplex lighting fittings exhibit at the display of industrial products staged by TI Electrical Division in co-operation with MANWEB at their Industries Centre, Liverpool

Restricted Home Market Unprofitable

—says Mr. Stanley of Pye

TRANSFER of export production from Cambridge to Italy if existing restrictions in the UK continue, that is the proposal being considered—it is almost a threat—by Mr C. O. Stanley, chairman of Pye Ltd. Main trouble is the television industry where present stocks amount to over one million sets and manufacturers are cutting output severely. Mr Stanley has just returned from Italy where Pye have bought a factory at Inverigo, near Milan, initially to gain a foothold in the Common Market. But the directors are now looking at this venture as a wider opportunity to sell in other countries using the 625-line system.

"If the Chancellor of the Exchequer really wants to make our UK market disappear, it might be much better not only to make TV sets in Italy for local sale in an expanding market, but with that basis to serve export buyers from Italy instead of from Cambridge," Mr Stanley has stated. He considered the present UK home market now so much restricted as to be unprofitable. "We will have to cut overheads and distribution costs, do a small business here of Cambridge-made sets, close the Northern Ireland factory and halve production at one of our other factories," he said. Although less than half the group's profits came from TV and radio, in his view it would be far better to trade from Eire or Italy rather than face losses here.

"We intend to make in Italy all the things we sell in Britain under the Pye trade-mark, including specialist instruments, communications equipment, specialist radio and telephone gear and some domestic electrical appliances, but not refrigerators," he added.

B.S.I. needs funds

THE Government having pegged its grant to the British Standards Institution for the next three years at a level only slightly above last year's rate, BSI needs greater financial support from industry if it is to carry out its job effectively. This view was emphasised by BSI leaders at the annual meeting recently. An approach to all subscribing members to change some conditions of membership as a step to increasing revenue had met with satisfactory initial response, the meeting was told.

Evidence of BSI's effectiveness is shown in a rise in sales of publications of British Standards from 890,000 copies in 1958-59 to a record 1,097,000 in the past year. Sales of overseas standards have almost doubled in four years.

Pointing out the UK's support for international standards, Sir Herbert Manzoni, a deputy president of BSI, told the meeting that there were British Standards corresponding to over three-quarters of the recommendations approved by the International Standards Organisation.

Sir Herbert recalled that agreement had been reached at Zürich a few months ago on steps for the co-ordination of the standards of countries in the "Six" and the "Seven."

Earlier this week the Radio and Television Industry sent a telegram to the Prime Minister urging government action to alleviate the effects on the industry of the present credit squeeze.

Electrical output high

ELECTRICAL engineering production was 10% higher in the first half of this year than in the corresponding period of 1959, but the advance slackened pace in the second quarter. The index compiled by the Board of Trade fell from 149 in the first quarter to a provisional 142 for the three months to June.

New orders received by the engineering and electrical goods industries declined by 13 p.c. in the second quarter from the particularly high level of the first three months, but recovered quite sharply in July.

OPINIONS ON CLEAN AIR

HOW the Clean Air Act is working, and what research is going on to help forward the drive to keep down atmospheric pollution, were important topics at last week's annual conference of the National Society for Clean Air, held at Harrogate under the chairmanship of Sir Hugh Beaver. In a report on a special investigation carried out by the Society it was stated that up to March, 1960, only 125 smoke control areas had been

created, by 67 local authorities. However, there were signs that such activity was gaining in momentum. Smoke control areas are in the main involving groups of about 500 premises, although up to 5,000 have been included.

Disappointment with the rate of progress under the Act was voiced by Sir Hugh Beaver in his presidential address, but he praised industry for the effort it was making to reduce air pollution. He mentioned specially new power stations, "all virtually smokeless, with very high performance grit arresting plants and chimneys up to 600 ft high."

As usual, an exhibition was held in connection with the conference. AEI showed their electrostatic method of measuring dust in furnace effluent. Berry's showed fires qualifying for grant under the Clean Air Act, while GEC also had electrical heating equipment on display, including block-storage heaters. L. G. Hawkins were another firm with exhibits in this field, while Thermotect Ltd. showed withdrawable floor-warming equipment. The electrostatic precipitator firms were well represented, including W. C. Holmes, Lodge-Cottrell, Simon-Carves and Sturtevant. The CEEB and EDA were amongst other stand holders.

Factory walls must be washable

FACTORY wall interiors must now be repainted as often as necessary to maintain a continuous film capable of being washed to the satisfaction of the factory inspector, under amendments to the Factories Act. The minimum interval of seven years between repainting has been retained, but the whole or part of a factory may be exempted. Greater flexibility in the choice of materials is introduced by allowing the use of "suitable" paint, instead of specifically "oil" paint. This brings the regulations into line with developments in the paint industry, such as plastics paints.

E.W.F. MEET IN SCOTLAND

Our photograph below was taken at the recent meeting of members of the Scottish Section of the Electrical Wholesalers' Federation and the Council of the EWF, held at Troon. It shows, back row (left to right): A. Baillie, J. A. Cartwright, J. Aikman, G. McIver, D. Boyle and A. Heggie; fourth row: L. B. Burn, T. S. Weston, H. D. Denman, G. W. Hamilton and A. McNeilage; third row: J. W. E. Rutherford, W. McIntosh, F. J. Blackwell, R. Melvin and E. H. Stein; second row: J. H. Hirst and C. H. Blackburn; front row: P. B. Etheridge (director), J. M. Milne, G. Conradi (president), J. Kerr (chairman, Scottish Section), H. Riley and J. Aikman, Jr. (secretary, Scottish Section)



E.D.A. aids floor-warming

TWO new publications on floor-warming have been issued by EDA. One is an 18-page booklet, mainly for the use of architects, *Notes on the Construction and Finish of Floors that are to be Electrically Warmed*; and the other an eight-page illustrated folder for salesmen, *Electrical Floor Warming, Questions and Answers*.

Two main methods of floor construction are considered in the booklet, monolithic and layered. In the first method the heating cables may be laid on the sub-floor while it is still plastic (if concrete) and covered with a screed; or within the concrete floor slab while it is being laid. Layered construction is the method employed for construction of suspended floors and where floors in contact with the ground have already hardened before heating cables and screed are laid. The booklet also discusses floor finishes and contains brief notes on electrical testing and system control.

Copies of the booklet (EDA 1927) and of the folder (EDA 1934) can be obtained from electricity service centres or direct from EDA, 2 Savoy Hill, W.C.2.

Faster computer system

A NEW medium-to-large general purpose digital computer system—the KDF9—is being introduced by English Electric Co. Among its features is a very high speed of operation (with a main core store of six microsec cycle time and multiplication in 14 microsec or less). Costing from £125,000 upwards, the first production model is scheduled for operation in 1962 and the company claim it will be many times faster in operation than any machine now in use in this country, without a comparable increase in costs.

Sayings

OF THE WEEK

"If electricity supply is to play a part in counter-cyclical operations, some fat must be put on the systems first. At present the bones of the distribution networks are almost showing through the skin." . . . MR R. S. EDWARDS, Electricity Council deputy chairman, writing on the ability of the supply industry to cope with ups and downs in the national economy.

"Any further talk of legislation to control office conditions or fire risks in offices or public buildings is simply wishful thinking unless such legislation is backed by workable powers of enforcement—and, most important, by a determination to enforce it." . . . J. CRABTREE, writing to *The Guardian*.

"Basic advances in science depend upon the creative individual. This process cannot be controlled; the theories that such progress can be produced merely by pouring in money and resources are without foundation." . . . Annual report of the Advisory Council on Scientific Policy.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, October 11

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	226½	—½	ZINC, virgin, min. 98% purity (cash) ...	88½	+1½
" (3 months) ...	228	—½	" (3 months) ...	88½	+½
LEAD, refined pig. 99.97% purity (cash) ...	66½	—2½	RUBBER, per lb No. 1, RSS, spot ...	28½d	—½d
" (3 months) ...	68½	—1½	c.i.f. basis, porta. Dec. ...	28½d	—½d
TIN, refined, min. 99.75% purity (settlement) ...	811	+9	ARMOURING: Galv. Steel Wire (0.104 in.) ...	66½	—
" (3 months) ...	801½	+3	Mild Steel Tape (0.04 x 1½ in.) ...	53°	—
ALUMINIUM, ingots 99.995% (3 months) ...	186	—	NICKEL (home) ...	600	—
wire bars (4 x 4 x 54") ...	193½	—	MERCURY (76 lb flask) ...	70	—
BRASS Strip 63/37 ...	200½	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	31c	—
SILVER (Troy oz) ...	79½d	+½d	Lead. (New York) ...	12c	—

* Tape Price, now an average, includes varnishing

Soviet Engineering's High Proportion of Women

THAT as many as 35% of qualified Russian engineers are women was revealed by a delegation recently returned from a visit to the USSR, organised by the Caroline Haslett Memorial Trust. Members of the delegation were Miss L. Souter and Miss R. Winslade, both practising electrical engineers, who discussed their experiences at a conference organised by the Electrical Association for Women. Employment of women on equal terms with men in all professions is the accepted norm in the Soviet Union today. Cases were quoted of women acting as supervising engineers over men in factories and even on heavy construction sites. Particular branches of professional engineering chosen appear to be evenly divided among Russian women engineers with a slight preference for engineering economics. Marriage is regarded as being complementary to a professional career.

These facts contrast sharply with the position of women engineers in the United Kingdom, shown by a recent Ministry of Labour survey, where the proportion of women in engineering is

only about 0.1%. The opinion widespread among British employers is that professional engineering is not, on the whole, a suitable occupation for women.

Electrify and Revive

"ELECTRIC rail services are economical and reliable and, as we have found from the Kent Coast scheme, there is enormous traffic potential," Sir Philip Walker, chairman, BTC Southern area board, stated on Monday. "At Folkestone, which was a dead town five years ago, every inch of building land is now bought at a high price," he went on. British Railways plan to electrify train services from London to Bournemouth, Weymouth and Salisbury in the next four years.

News in Brief

Demand for tickets for the EIBA ball at Grosvenor Hse on 11 Nov. is exceeding the number of guests that can be accommodated, we are told.

Taylor Electrical Industries—a member of the Metal Industries Group—sold all the equipment they exhibited at the recent Bruno Fair, Czechoslovakia, and took orders worth a further £1,000.

A 22-year-old trolley-bus presented by London Transport to the Association pour le Musée des Transports Urbains, Interurbains et Ruraux for its Paris museum was taken across the Channel last week-end. It has a Leyland chassis.

Evershed and Vignoles Ltd. recently held their first apprentice "open day" which parents, education officers, youth employment officers and teachers attended.

Mr L. Rotherham, Member for Research, CEBG, will lecture on "The Contribution of Metallurgy to Electric Power Generation" in London on 29 Nov. as the Hatfield Memorial Lecture for the Iron and Steel Institute.

The net surplus of the Belfast electricity undertaking for the year ended 31 March last is £198,432—not £791,094 as we incorrectly stated on 25 Aug.

L.C.C. to try oil hot-air heating

EXPERIMENTS with hot-air space heating for isolated tall blocks of flats, using a roof-mounted oil-fired boiler, are planned by the LCC Housing Committee. Location of the oil-fired boiler on the roof avoids the need to provide a flue the full height of the block. Warm air units will have outlets into the hall, kitchen and living room of the individual flats.

The system is designed to give continuous background heating throughout the flat to about 10°F above the outside temperature and the tenant will be able to increase output of the heating unit to 5 kW.

Installed in a 17-storey block of flats in place of electric floor-warming, the hot-air heating installation is calculated to involve an additional capital cost of £6,565, or about £98/dwelling.

Electricity will be left with the water heating load when this hot-air method of heating is installed.

Company Activities

ew fortnightly Stock Exchange unit which opened last week to be a bouncing baby. After a fortnight things really began to hum. Though business was as usual, prices stayed on the upgrade. Many folk were frankly puzzled by the strength. Shortage of stock, why prices should be sensitive and, but hardly why buyers have suddenly taken fresh News from Wall Street is not the latest hire-purchase figures, but the credit squeeze is working. It is asked, do investors derive inspiration? The answer seems to be: continuing good health of the end of industry. Booming machine tools and the appointment of motor-car manufacturers to go ahead with their vast programmes draw attention to buoyancy in the economy even now. If and when the Government feels able to relax its credit, the industry should fairly roar. Since the recent interest in good shares, the further increase in gold and convertible currency last month has been favourably noted in this respect, but it would be to base hopes of an early rise in Bank rate purely on this factor.

But in the gilt-edged sector has been the efforts of the Government to establish control over the "long" market by a new issue of £100 million Treasury stock. 2008 Government departments took up the stock which started life in the market at 95½ a premium of ½ to offer price. Another recent issue of gilts has been some energetic support into conversion 5% 1971, the Government's medium "up" stock.

Generally cheerful atmosphere of shares managed to move ahead reports that the rate of expansion in the engineering and electrical

industries is slowing down. Gains tended to be modest and seldom exceeded 1s with the exception, that is, of Crabtree Electrical which jumped 5s in two days. The company's results are expected out later this month and it looks as if the "bulls" are moving in for a short-term profit on hopes that the final dividend forecast of "not less than" 7½% will be exceeded. Scarcity of stock might account for the speed of the rise in the price though of course for a company of medium size like Crabtree a take-over situation cannot be completely ruled out.

Another name that stood out was Vactric where a veritable see-saw took the shares down to 9s 7½d prior to the announcement last week-end that the bankers have appointed a receiver and manager (see page 571).

A bigger row is blowing up over Ada (Halifax), the washing machine and machine tool manufacturers, which last year also started making domestic refrigerators. The Philips Electrical giant has stated that its offer for Ada has been effectively accepted in respect of approximately 70% of the Ordinary shares it does not already hold. But at the eleventh hour the shareholders' committee, which was formed to oppose the bid, is considering applying to the Board of Trade for an investigation into the company's affairs.

The other takeover in the electrical industry is proceeding more smoothly. EMI has announced the receipt of acceptances in respect of over 98½% of the Morphy-Richards Ordinary stock. In due course action will be taken to acquire the outstanding balance.

The shares of Relay Exchanges jumped 1s 6d on the favourable half-time report. The directors have stated that business continues to expand and pass the benefit on to shareholders with an interim dividend maintained at 8% on a capital increased to £4,526,069 by rights and scrip issues. The 1959 interim is equivalent to 5½% on the present equity.—*From our City Correspondent.*

Halifax Ltd.

A number of shareholders who are disappointed with Philips' takeover offer for 1s share are endeavouring to improve offer. Alternatively, they want a representative of the shareholders elected to the Ada

Ada Ltd.

It is to be a one-for-five scrip and the directors propose to pay an interim of 6% (the same as 1959) on the increased capital.

Aluminium Co. Ltd.

Estimated trading profit for the year ended 31 July last amounts to

£143,000 (£144,461). Final dividend is raised 4% to 14%, making the total 20% (14½%).

Kenwood Manufacturing Co.

There was little encouraging news for shareholders at last Thursday's adjourned annual meeting and Mr J. H. Senior, the chairman, explained that with the physical stocktakings and consolidation of the figures for the first joint year including overseas subsidiaries, it was impossible to produce accounts yet or even to quote figures, as these had not been completed. The full accounts should be available in December, by which time he hoped that results from August onwards would have helped considerably to restore the effects of the setback. Sales of the new "Kenwood Chef" in August and September were 50% above the highest level ever reached by its predecessor and demand is still well in excess of supply, he added.

Richard Johnson, Clapham and Morris

A final dividend of 15% makes a total of 20% for the year ended 30 June last on old capital (same), and 3½% is to be paid on the new rights shares, as forecast. Trading profit is £64,017 (£57,229) before taxation.

Perak River Hydro-Electric Power Co.

There is better news on operations for the year ended 31 July last. In addition to a final dividend of 6%, making the total 10%, there is a special dividend of 5% which is recommended in view of the lower return on shareholders' investments during the period of tin restriction. In the previous year only 5% was paid. Net profit for the year just ended rose to £532,686 (£146,161) after charging depreciation at £320,000 (£300,000), but before tax of £237,535 (£76,000).

Pifco Holdings

Turnover for the first four months of the current financial year has been maintained and the order book is satisfactory, Mr A. D. Webber, the chairman, reports. He considers the reimposition of hire-purchase restrictions could even be beneficial to the company, for the earlier removal did not bring any benefit, retailers preferring to promote the sale of major household appliances. The amount due to the vendors of shares in the subsidiary company, Pifco Ltd., has been reduced by £20,452—and at the end of April amounted to £489,548. It is the intention of the board to pay off a substantial part of the balance during the present year and it is hoped to discharge the remainder as soon as possible.

Intended Dividends

Barton and Sons. Interim 7½% (5%). The increase being to reduce disparity between interim and final payments.

Relay Exchanges. Interim 8% on increased capital (against equivalent of 5½%).

£5,133,651, and there is a final dividend of 8% making a total of 12%. For the previous seven months, trading profit was £2,004,418 with a single payment of 5%.

Copeland and Jenkins (Holdings)

It is proposed to increase the capital to £1 million by the formation of 400,000 unclassified £1 shares. The directors say that this increase will enable them to deal with any opportunity which may occur, although they are not aware of any at the moment.

Electrical Apparatus Co.

After charging taxation at £127,000 (£113,403), the net profit for the year to

COMMERCIAL INFORMATION

Contracts 'Open at Home' . . .

Dates given are the final for receipt of tenders unless otherwise stated.

- 13 Oct.—Stornoway Pier and Harbour Commission.** Electrical work in erection of Customs Hse/Government offices/two dwellings in South Beach/Quay St.—See 6 Oct. issue.
- 14 Oct.—Hitchin U.D.C.** Erection and commissioning of 30 Class "A" and 65 Class "B" lighting units in various areas.—See 6 Oct. issue.
- 14 Oct.—Maidstone B.C.** Scheme PW9, electrical installations in 24 flats in four blocks on Parkwood Housing estate.—See 6 Oct. issue.
- 14 Oct.—North Riding C.C.** Installation of passenger lift and alterations to 19 Royal Cres, Whitby. Applications to County Architect, County Hall, Northallerton, by above date.
- 14 Oct.—Ross and Cromarty C.C. (g)** Electrical work in erection of two blocks of two four-apartment houses at Tore, Black Isle.—See 6 Oct. issue.
- 17 Oct.—Chelmsford R.D.C.** Provision and erection of 64 Group "A", 25 ft concrete columns/brackets and 140 W side entry sodium lanterns/lamps/gear along A12 at Mountnessing.—See 6 Oct. issue.
- 17 Oct.—Eccles B.C.** Electrical installation including underfloor heating in proposed Peel Green Branch Library. Engineer and Surveyor, Town Hall Annexe, Irwell Pl.
- 17 Oct.—Knaresborough U.D.C.** Supply and erection of 50 Group "A" concrete columns with sodium discharge lamps/control gear for Bond End/Boroughbridge Rd street lighting.—See 6 Oct. issue.
- 17 Oct.—Northants C.C. (b)** Electrical installations in Corby Beanfield new infants' school and Roade Modern School extension. Applications to County Architect, County Hall, Northampton, by above date.
- 17 Oct.—Poole B.C. (Item b5).** Electrical installation in erection of 10,755 sq ft six-classroom Hillbourne Primary School. Applications to Borough Architect, by above date.
- 17 Oct.—Wallasey C.B.** Electrical installation in Moreton Secondary Modern School extensions.—Advertised 29 Sept. issue.
- 18 Oct.—Beverley R.D.C. (e)** Electrical installation additions to 39 houses at Newbald, Wawne, Lund, Cherry Burton, Woodmansey, Little Weighton, Skidley and Swanland.—See 29 Sept. issue.
- 18 Oct.—Littlehampton U.D.C. (Contract 24).** Electrical installations in six houses, Helyer's Gn, Wickbourne estate.—See 6 Oct. issue.
- 18 Oct.—Liverpool C.C.** Supply of (a) 1 kW transformers; (b) fluorescent fittings; (c) fluorescent tubes. General Manager, City Markets Dept., Stanley Abattoir, Prescot Rd, Liverpool 13.
- 18 Oct.—Manchester C.C.** Supply of 2,000 time switches during 1961. City Surveyor, Town Hall.
- 18 Oct.—Newton Abbot R.D.C. (1)** Supply of ten Group "B" fluted steel columns/brackets/lanterns/time switches; (2) supply, erection and commissioning of 61 Group "A" columns/lanterns at Kingskerswell. Engineer and Surveyor, Council Offices, Kingsteignton Rd. Deposit £2 2s each contract.
- 19 Oct.—Durham C.C.** Electrical installation renewal at Houghton-le-Spring R.C. (Aided) School and Shotley Bridge E. F. Peile Convalescent Home. Applications to County Architect, G. W. Gelson, South St, Durham, by above date.
- 19 Oct.—Kirkburton U.D.C.** Supply and installation of 88 200 W sodium discharge lamps on 35 ft steel columns for A629 Penistone Rd (second part) lighting.—See 29 Sept. issue.
- 19 Oct.—Sunderland T.C.** Cable laying, 2,000 yd of 2-, 3- and 4-core p.i.l.c.s.t.a. cable for street lighting.—See 29 Sept. issue.
- 20 Oct.—Louth R.D.C.** Contract 29: Supply and erection of 18,750 g.p.h. duplicate horizontal centrifugal booster pumps together with motors, starters and accessories for Kenwick Reservoir.—See 6 Oct. issue.
- 20 Oct.—Penybont R.D.C. (d)** Lighting scheme for Llangynwyd comprising 140 W sodium lamps on 25 ft columns. Engineer and Surveyor, Greenmeadow, Coity Rd, Bridgend. Deposit £3 3s.
- 21 Oct.—Bristol C.C.** Supply of lamps, batteries, transformers, capacitors, sundries, cables, etc., for year.—Advertised 6 Oct. issue.
- 21 Oct.—Cork.** Electrical services installation at Cork Airport.—See 6 Oct. issue.
- 22 Oct.—Bexhill B.C.** Supply, erection and putting into service of 52 140 W sodium lamps on 25 ft reinforced concrete columns.—See 29 Sept. issue.
- 21 Oct.—New Windsor B.C.** Street lighting installation scheme, 1961: (a) 26 400 W colour-corrected mercury lamps on wall brackets for Thames St/High St area; (b) 17 80-125 W mercury on brackets; (c) six 80-125 W mercury in special lanterns; (d) removal of existing Group "A" steel columns. Borough Engineer, Kipling Bldg, Alma Rd.
- 22 Oct.—Lichfield C.C.** Supply, erection and installation of 15 Group "A" steel columns, sodium lanterns and ancillary equipment for Sandford St lighting. City Engineer and Surveyor, D. Oglesby, Meredith Hse, 62 Wade St. Deposit £2 2s.—Advertised in this issue.
- 22 Oct.—Seaton Valley U.D.C.** Supply and erection of 329 units and supply only of 132 units for street lighting scheme.—See 6 Oct. issue.
- 24 Oct.—Adlington U.D.C.** Supply, erection and wiring of 16 60 W sodium lamps replacing tungsten at Railway Rd, B6227. Surveyor, N. R. Bolton, Council Office, Railway Rd, Adlington, Chorley.
- 24 Oct.—Beverley R.D.C.** Supply and erection of: Contract 2, two 180 g.p.m. sewage pumps and two 100 g.p.m. sludge pumps; Contract 3, four 40 g.p.m. and two 30 g.p.m. sewage ejectors for Leven and Tickton Sewerage Schemes.—See 29 Sept. issue.
- 24 Oct.—Billingham U.D.C. (Contract L1.)** Supply: 15 concrete columns, A19; (L2) supply: 69 steel columns, A19; (L3) supply: 140 W sodium lanterns/lamps/gear; (L4) supply: 400 W m.v. lanterns/lamps/gear; (L5) provision and laying of cables, servicing of columns and lanterns; (L6) erection: 84 columns/lanterns, A19; (L7) provision and laying cables, New Rd; (L8) erection: 33 columns, New Rd; (L9) provision and laying cables, Haverton Hill Rd; (L10) erection: 59 columns/lanterns, Haverton Hill Rd; (L11) supply: 92 concrete columns, New and Haverton Hill Rds.—See 6 Oct. issue.
- 24 Oct.—E.B. for N. Ireland.** Supply and erection of lighting and heating for No. 3 set at Coolkeeragh Power Station.—See 29 Sept. issue.
- 24 Oct.—Ellesmere Port B.C.** Provision and erection of 34 Group "A" concrete columns/lamps complete, contract No. 298, for A41 Chester/Birkenhead Trunk Rd. Borough Engineer and Surveyor, Queen St.
- 24 Oct.—Kingston upon Thames.** Roof renewal, electrical ancillary works, etc., at Corpn. Depot.—See 29 Sept. issue.
- 24 Oct.—Pelton P.C.** Erection of 30 60 W sodium lamps on concrete columns.—See 6 Oct. issue.
- 24 Oct.—S. Devon Water Board.** Supply of 1,800 g.p.h. at a 286 ft head duplicate pumps and ancillary equipment for Sheldon Pumping Station.—See 6 Oct. issue.
- 25 Oct.—Ealing B.C. (a)** Supply of 88 140 W sodium lanterns/lamps/gear; (b) supply and erection of 85 25 ft steel columns.—Advertised 15 Sept. issue.
- 26 Oct.—Cardiff C.C.** Complete £38,000 electrical installation, by contractors on N.I.C.E.I.C. roll, in proposed Teachers' Training College, Cyncoed.—See 29 Sept. issue.
- 26 Oct.—Eire C.I.E.** Form 137. Supply of lamps for premises and automobiles. Purchasing Officer, Inchicore, Dublin.
- 26 Oct.—Manchester C.C. (a)** Electrical installation and (b) supply and erection of passenger/goods lift in new hostel block, Didsbury Training College. City Architect, P.O. Box 488, Town Hall.
- 26 Oct.—Newbury B.C.** Supply and erection at London Rd Pumping Station of two v.s. (each 186,000 g.p.h.) and three (each 75,000 g.p.h.) centrifugal pumps for unscreened sewage. Details from consulting engineers: Howard Humphreys and Sons, West St, Epsom. Deposit £5 5s, made payable to B.C.
- 26 Oct.—Whitchurch U.D.C.** Phase 1. Supply, erection and wiring of 45 150 W sodium lamps on 25 ft concrete columns and 59 85 W sodium on 15 ft columns.—Advertised 29 Sept. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Orrefors" glass lighting fittings—agents for? E.H.M.—J. Wuidart and Co. Ltd., 15 Rathbone Pl, W.1.

Self-illuminated flower vases—makers of? E.E.B.—Miller Kent Decoratives Ltd., 106 George St, W.1.

"Desilux" horns—makers of? A.W. and D.—Desilux Electrical Equipments, 143 Whitfield St, W.1.

"Thermotube" tubular heaters—makers of? L.E.B.—E. K. Cole Ltd., Ekco Wks, Southend-on-Sea, Essex.

"Cheeto" food mixers—suppliers of? E.E.—Edmundsons Electrical Wholesalers Ltd., 240-250 Ferndale Rd, S.W.9.

"Kanthal" resistance wire—address for? T.E.—Hall and Pickles Ltd., 64 Port St, Manchester 1.

"Expandet" PVC screw anchorings—makers of? A.W.C.—Expanded Plugs Ltd., 9 College Hill, E.C.4.

"Maytag" washing machines—repairers of? E.E.W.—A.E.I.—Hotpoint Ltd., 11 Avon Trading Estate, Avonmore Rd, W.14.

ANSWERS WANTED

United States Electrical Tool Co., Cincinnati—agents for? G. and H.—

"Super-Vac" vacuum cleaners—address for? S.W.B.—

4.—Heston and Isleworth B.C. Re-supply and fixing of power outlets Contract 1, 92 houses; Contract 2, 102; and Contract 3, 105 houses on estate, Isleworth. Housing Officer in charge, Housing Dept., Treaty Rd. low.—Advertised in this issue.

5.—Leighton Buzzard U.D.C. Erection Group "A" Stanton columns with lanterns/gear along A4012; resiting the provision of new lanterns of Group "B" columns and the erection of additional Stanton columns/lanterns Stanbridge Rd, C238. Engineer and/or, Council Offices, North St. Deposit

6.—Oldham C.B. Conversion of 15 nical public clocks to electric drive tric wind.—Advertised 29 Sept. issue.

7.—Down C.C. All-electric lighting and installation in Child Health and e Clinic, Knockree Ave, Kilkeel. e from consulting engineers, Barrett gnew, 420 Ravenhill Rd, Belfast 6. it £3.

8.—New Windsor B.C. Supply of 15 lamps and (Item 21) fittings and for year to 31 Dec., 1961.—See 6 Oct.

9.—New Windsor. Electrical instal- in two maisonnettes at Clewer New Borough Engineer, Kipling Bldg, Rd.

10.—N.A.T.O. Infrastructure. Provision roving of a very low-frequency radio- ph transmitting station in North of id. Applications to The Director, Post Contracts Dept. (A25), Telephone l'emple Ave, E.C.4, by above date.— ised in this issue.

11.—Matlock U.D.C. Supply and instal- complete of nine sewage pumps at pumping stations in Darley Vale.— Oct. issue.

12.—Fylde Water Board. Supply of eorder panel and hydraulic measuring

equipment. Engineer, Sefton St, Blackpool. —Advertised in this issue.

No date stated—Haddington B.C. (Item 6). Electrical installation in office reconstruction scheme at Caryle Rooms, Lodge St; and (Item 7) electrical work in 22 houses in seven blocks on Abercroft site. Details from Surveyors: R. T. B. Gilray, 60 Castle St, Edinburgh.

No date stated—N. of Scotland H.E.B. 60 MVA transformer for Persley substation, Aberdeen. Chief Electrical and Mechanical Engineer, 16 Rothesay Terr, Edinburgh 3.— Advertised in this issue.

No date stated—St. Faith's and Aylsham R.D.C. Supply of columns, lanterns, lamps and auxiliary equipment. Council Clerk, Tudor Hall, Rose La, Norwich.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

18 Oct.—Burma. Batteries (four items) up to 12 V 100 A in quantities up to 1,500, 7/029 and 7/036 single-core weatherproof cable. Two 30 h.p. motors and two starters for 20 h.p. motors. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/26078/9 and 80/60).*

20 Oct.—Jordan. Cables, boxes, cleats, bituminous compound and soldering compound. Jordan Phosphate Mines Co. S.A., P.O. Box 30, Amman. B.o.T. (ESB/26027/60/DLF).*

21 Oct.—New Zealand. 5,720 yd pilot cable, joint boxes, jointing compound and material. 9,240 yd of 0.3 0.35 sq in. 22 kV "H" type cable. Chairman, Auckland Electric Power Board, Queen St, Auckland, C.I. B.o.T. (ESB/24671 and 2/60).*

23 Oct.—Kuwait. 2,000 window type air-conditioning units. Department of Electricity, Kuwait. B.o.T. (ESB/24181/60).*

24 Oct.—India. Ten items, transformers, switches, lightning arresters and fuses for 33 kV substations. Chief Engineer, Electricity, Mysore State E.B., Post Bag 15, Bangalore 1. B.o.T. (ESB/26011/60).*

26 Oct.—Thailand. Three 1 MW generating sets. Thailand Tobacco Monopoly, 184 Sukumvit Rd, South Nana La, Bangkok. B.o.T. (ESB/24685/60).*

27 Oct.—America. Two autotransformers and one 3-ph 69 kV shunt capacitor. Dept. of Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center, Denver 25, Colorado. B.o.T. (ESB/25981 and 2/60).*

28 Oct.—New Zealand. Four items, resistors from 680 to 10,000 ohms fixed and adjustable in quantities of 50 and 100. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/24675/60).*

1 Nov.—New Zealand. Six moving-coil 45-55 V d.c. 9 in. diameter volt meters. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/24676/60).*

2 Nov.—India. One 20 ton o/h travelling crane with 6 ton auxiliary hoist. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/26012/60).*

7 Nov.—Australia. 132 kV double circuit galvanised steel tower transmission line for Kuringai substation loop. E.C. of N.S.W., Kelvin Hse, 15 Castlereagh St, Sydney. B.o.T. (ESB/24674/60).*

8 Nov.—Pakistan. Three 66 kV substations (excluding power transformers). Miner and Miner International Inc., P.O. Box 748, Greeley, Colorado, U.S.A. B.o.T. (ESB/26156/60/DLF).*

15 Nov.—Canada. Three 150,000 h.p. turbines for Grand Rapids. Mr D. M. Stephens, Chairman and General Manager, Manitoba H.E.B., P.O. Box 815, Winnipeg. B.o.T. (ESB/13924/60).*

15 Nov.—India. 97,000 c.f.m. induced draught fan for use with three B. and W. boilers. Assistant Engineer (Generation), Rajasthan State Electricity Board, Jaipur. B.o.T. (ESB/26077/60).*

16 Nov.—Australia. Thirteen 22 kV o.c.b.'s. Secretary, Victorian Railways, Spencer St, Melbourne C.I. B.o.T. (ESB/25932/60).*

17 Nov.—India. 155 tons of 2½, 3½ and 5 mil cable insulating paper. Details, fee 10s, from C.D.N. Branch, India Store Dept., Bromyard Ave, W.3. Reference 1221/60 (CDN).

15 Dec.—Malaya. Two 10 MW turbo-alternators and auxiliaries for C.E.B. Johore Bahru Power Station. Précis (documents fee £15), from Crown Agents, 4 Millbank, S.W.1. Reference E.E. 1737/1.

CONTRACTS PLACED

1.—Port B.C. North Allington Group "B" lighting installation, A.E.I. Lamp and ng Co. Ltd., £2,236. Recommended.

2.—Chester B.C. Installation of 28 Group columns and removal of redundant nent along Weymouth Ave and Trinity 54, Abacus Municipal Ltd.

3.—Ham C.C. Electrical work in schools: Lambton County School, R. Robson, ; Eggescliffe new modern school, Cox-rs Ltd., £6,384; Neville's Cross Train-llage and Easington Technical College, of England Engineering and Electrical £9,316 and £17,648, respectively; path Nursery School, Bishop Auck-Barrington C.E. School and Spenny-new dental clinic, James Paterson and £421, £957 and £440, respectively; e Dene Hse Modern School, T. lson (Electrical) Ltd., £7,914; Wash-Grammar Technical School, Devereux ie and Co. Ltd., £420. Recommended.

4.—Don C.C. Electrical installation iment and renewal at Harwood County y School, L. Power and Son Ltd., 2s.

5.—Llumberland C.C. Electrical installa- Whitley Bay Fire Station £30,000 ex-1, Robson and Coleman Ltd.

6.—ley U.D.C. Supply, erection and wiring up "A" columns along B6347, Belper idland Lighting and Bldg Ltd., £1,129. imended.

7.—hampton B.C. Electrical installation il at Springhill R.C. School, G. 1, £955. Recommended.

8.—h Shields T.C. Rewiring of St. Bede's Primary School, A. J. Wares Ltd., ; electrical work in further instal- of South Shields Marine and Technical e, C. Ramsay and Son, £29,310. imended.

9.—Stockton-on-Tees T.C. Electrical installa- in new Fairfield Infants' School, Cox-Walkers Ltd., £1,866. Recommended.

10.—Walthamstow B.C. Electrical installation in 16-18 Prospect Hill, Woodford Electrical Co., £1,625. Recommended.

11.—Withernsea U.D.C. Supply and erection of 65 60 W sodium lamps/lanterns/gear on 15 ft concrete columns, A.E.I. Lamp and Lighting Co. Ltd., £1,504.

TRADE NOTES

Change of Addresses. The north-west area offices of the Electric Construction Co. Ltd., and E.C.C. (Moulded Breakers) Ltd., is now at Bushbury Hse, 435 Wilmslow Rd, Wingham, Manchester 20. Telephone Didsbury 8761. Area Manager of Electric Construction is Mr J. H. Charnley, and North of England sales manager of E.C.C. (Moulded Breakers) is Mr J. T. Jolley.

As from 14 Oct. the Production, Inspection and Test Section (Newcastle Region) of the C.E.G.B. will move to 31 Mosley St, Newcastle upon Tyne. The telephone number remains 20610.

New 'Phone No. The telephone number of Belling and Lee Ltd. has been changed to Enfield 5393.

E.W.F. Ellistons (Welwyn) Ltd., 17-21 Brownfields, Welwyn Garden City, have been elected members of the Electrical Wholesalers Federation.

Agreements. Bristol Aerojet Ltd. and Permali Ltd. have entered into an agree-ment whereby the two companies will col-laborate in the manufacture and sale of tubular structures of helically wound glass-fibre rovings bonded with synthetic resin. Bristol aerojet are to manufacture, and Permali will undertake sales.

An agreement has recently been signed between Smiths Industrial Division and the ABEM Co., Stockholm, each company hav-ing appointed the other as sole distributor of their high speed pen recording and laboratory equipment in specified areas. Smiths Industrial Division will be sole dis-tributors of ABEM recording equipment in the U.K., U.S.A., the Commonwealth and certain territories in Europe, whilst ABEM Co. will be sole distributor of Kelvin Hughes recording equipment in Sweden, Norway, Denmark and Finland.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Hipac. 800,650. Class 9. Capacitors Ltd., 204-224 Soho Hill, Handsworth, Birming-ham 19.

Lucifer. 799,590. Class 9. Solenoid-operated valves. Lucifer S.A., 14 Route de St. Julien, Carouge-Geneva, Switzerland.

Vedette Compact. 805,293. Class 7. Wash-ing machines, etc. Societe Surmelec, 74 rue de Surmelin, Paris, France.

BUSINESS PROSPECTS

Alanwick. B. H. Brown (Engineering), 22 Main Rd, Kenton, Bank Foot, Newcastle, plan agricultural machinery servicing depot on industrial estate.

Andover. Wessex Hospital Board, Romsey Rd, Winchester, plans out-patients' dept. at Andover War Memorial Hospital at £30,000.

Ashton-under-Lyne. George Nixon and Co., Good Hope Mills, plan Brook St works extensions.

Beddington and Wallington. Vincent Burr and Ptnrs, 84 Gower St, W.C.1, recommended architects for building on Grange Mansion site for receptions.

Belfast. The Northern Bank, Victoria St, plan £200,000 bank building in High St.

Belford. Turley and Associates, 46 Jesmond Rd, Newcastle, architects for R.D.C.'s plan for council offices, Burnside estate.

Billingham-on-Tees U.D.C. Elder and Lester, Midland Bank Chmbrs., Town Sq, Billingham, architects for £1 million shopping centre scheme.—T.C. Plan 1,293 houses on four sites in district. Engineer.

Blackburn. Park Bros., Bankfield Wks, plan Gate St factory.

Bradford T.C. Lighting improvement in overhauling workshop, Thornbury Wks, at £3,000.—£68,700 modernisation of 454 houses Odsal estate planned involving provision of light points in toilets and five power points in each house.

Brighton. Westminster Construction Co., 36 Westminster Palace Gdns, S.W.1, contractors for Waterloo Pl office block planned by C. and G. Finance Corporation.

Bristol. R. Beecroft and Ptnrs, 11 Orchard St, Bristol 1, architects for General Business Services (Bristol) Ltd.'s new offices.

Bromsgrove. Ministry of Works (Architects' Dept., John Islip St, S.W.1) plan Stoke Heath airfield site prison.

Chatham. Farms and Ptnrs, 24 Welbeck Way, W.1, plan New Rd printing works.—B.C. Tender: 25 flatlets, Wayfield Rd. Engineer and Surveyor.

Chesterfield T.C. A61 trunk road lighting scheme at £6,476 planned. Surveyor.—£5,459 conversion of gas street lighting to electricity. Engineer.

Corby. Old people's home off Gainsborough Rd plan at £45,000. Architect.

Coventry. Norton Hill Estates Ltd. plan 96 flats in three-storey construction at Walsgrave.—J. Poulton (Ascot) Ltd., plan 30 Yewdale Cres houses.

Croydon. S.E.E.B., 10 Queen's Gdns, Hove, plan Factory La workshops, stores, etc.—Standard Printing Co., Purley Rd, plan printing works extensions.—Warner and Son, Vulcan Way, New Addington, plan factory extensions.—B.C. Stage 3 of improved lighting scheme planned for 29 streets at £17,000.

Deal. Sir James Miller and Ptnrs, 7 Suffolk St, S.W.1, plan scheme for 300 flats, supermarket, etc., on site of Walmer Pl.—Jackson and Jackson, 149 Sandgate Rd, Folkestone, architects for 12 flats Dover Rd.

Deben (Suffolk). Melton Grange Property Co. plan development of 18-acre site rear Melton Grange Hotel, Pytches Rd.

Dewsbury. Seven-storey shop and office block at Wakefield Rd planned by M. Harrison and Co., Farnley, Leeds.

Douglas I.o.M. Quiggin and Co. plan rebuilding of sawmill, etc., at Lake Rd.

Durham. K. Dancer, 14 Hagley Rd, Stourbridge, Wores, architect for Richmond Sausage Co.'s planned additions to Gilesgate Moor Bakery.—C.C. New child welfare centre at Winlaton planned. Architect. C.C. Tender: High Coniscliffe County Junior and Infant School, maternity and child welfare centre at Newton Aycliffe and alterations at Frosterley South County School. Architect.

Eastbourne. Trustees of the Chatsworth Settlement plan new home for aged.

Edmonton. N. Stinehill Furniture Co. plan factory and offices at Angel Factory Colony

Elstree P.C. £1,370 Barnet La lighting scheme planned.

Ennerdale. John Laing and Son, Dalston Rd, Carlisle, contractors for 113 houses at Whitecroft, Gosforth; and 12 bungalows at Egremont.

Essex C.C. Tender: Colchester Pettygate County Infants' School at £42,000. Architect.

Farnborough. Daniel T. Jackson Ltd., Roebuck Rd, Hainault, Essex, plan development of Cove Brook land for up to 1,500 dwellings and shopping centre, etc.

Gateshead E.C. Tender: £170,000 extension to Technical College, Borough Engineer.

Glenrothes (Fife). Bechman Instruments, Queensway Industrial Estate, plan £100,000 addition to their new town factory.

Grimshy R.D.C. Class A lighting planned along Louth Rd and Pywripe Rd. Surveyor.

Guldford. C. Brewer and Sons, Old Palace Rd, Croydon, plan buildings on Woodbridge Meadows industrial estate.

Hastings. Hallmark Group, 26 Regency Sq, Brighton 1, plan 150 dwellings, Old Roar Farm.—Thorburn Muirhead and Ptnrs, St. Leonards-on-Sea, plan 22-storey block of 145 flats, restaurant, etc., on site of Grand Hotel. Architect: Thomas Sibthorpe, 10 Manchester Sq, W.1.

Havant and Waterloo U.D.C. Tender: 12 flats in two blocks and one bungalow, Fairfield Rd. Engineer and Surveyor.

Hemel Hempstead. C. Miskin and Sons, Romelands, St. Albans, Herts, contractors for £26,000 foundry extensions for Hemel Hempstead Engineering Co.

Hyde B.C. Tender: Lilly St housing estate to comprise 32 houses, 20 maisonnettes and 20 flats. Surveyor.

Leeds T.C. Tender: 86 bungalows and 10 houses at Cardigan La, Moorside, Belle Isle and Gipton. Architect, Priestley Hse, Quarry Hill.

London. Llewellyn Smith and Waters, 103 Old Brompton Rd, S.W.7, architects for £100,000 modernisation of offices of Inde Coope and Allsopp, Cannon Brewery, Finsbury, E.C.1.—Dawneys Ltd. plan first stage of three-storey and final stage of ten-storey administrative block, York Rd, S.W.—Stock, Page and Stock, 3 Fanshaw St, N.1, architects, plan new warehouse and office accommodation in Goodwood Rd, S.E.14.—Ellis, Clarke and Gallannaugh, 37 Soho Sq, W.1, plan office block on site of Hackney Empire Music Hall, Mare St, E.—R. Seifert and Ptnrs, 28 Gt. Ormond St, W.C.1, architects for £800,000 development on behalf of Oldham Estates for three seven-storey blocks, E.C.—L. C. Morton, 4 St. George St, W.1, architects for three-storey building planned for 1-4 Hatton Gdn, E.C.1.—H. Fitzroy Robinson, 3 Gray's Inn Sq, W.C.1, architects for 33-storey building on Esso site at 80-85 Albert Embankment.—Devereux and Davies, 3 Gower St, W.C.1, architects for Landfranc Holdings' Westminster Bridge Rd offices, S.E.1.—H. Owen Luder, 79 Regency St, S.W.1, architect for multi-storey block shops and offices, Catford Rd, Lewisham, S.E.—F. J. D. Daley, 45 Blackfriars Rd, S.E.1, architect for multi-storey block on site 217-230 Blackfriars Rd, S.E.1.

Manchester T.C. Tender: Contract 352, 42 dwellings, Miles Platting; and 354, 229 dwellings, Collyhurst, Director of Housing.—Home for aged planned in Goodier St, Harpurhey, at £66,964.

Meltham U.D.C. Lighting scheme planned at £2,057.

Middlesbrough. J. T. Bell and Sons plan development of site of Old Merchant Navy Club, Borough Rd: eight-storey building containing conference suites, offices, etc.

Newbury. Gunton and Gunton, Empire Hse, St. Martins-le-Grand, E.C.1, architects for West St office block for Rishton Management Ltd.

Newcastle. Corporation plans £1 million terminal buildings extensions at Woostington Airport. Engineer.—Also £1½ million Scotswood Rd abattoir.

New Sarum T.C. Tender: Ten houses, four flats, Stratford Rd, Salisbury. Engineer.

Northumberland. C.C. plan welfare homes at Berwick and Ashington at £146,500 and Merley Court, Morpeth, £51,000. Architect, Newcastle.

Oxford. Architects' Dept., Ministry of Works, Abell Hse, John Islip St, S.W.1, prepared plans for £190,000 radio station planned at Leafield.

Peterborough T.C. Electrical heating planned for roadway surface at junction of Bridge St and Embankment Rd. Engineer.

Pontypridd. Pontypridd and Rhondda Hospital Management Committee plan £600,000 scheme for redevelopment of Graig Hospital.

Redcar T.C. £100,000 scheme for Zeland Park ballroom planned. Engineer.

Rotherham. Pearl Assurance Co., High Holborn, W.C.1, plan office block on Ship Hill.

St. Albans T.C. Tender: 48 houses, Jersey Farm estate. Engineer and Surveyor.

Scunthorpe B.C. Tender: 14-storey block of 79 flats, Westcliffe estate. Clerk.

Sedgeley. Bighton and Sons, 25 Oakham Fields, Dudley, Worcs, plan engineering factory on Dormston trading estate.

Sheffield. Regional Hospital Board, Fulwood Hse, Old Fulwood Rd, plans hospitals at Ashgate, Chesterfield and at Oakwood Hall, Rotherham.

Southall. Tooley and Foster, Midland Bank Chmbrs, Buckhurst Hill, Essex, architects for £130,000 extensions to St. Bernard's Hospital.

Southend-on-Sea. Derek Silverton, 79 High St, Southend, architect for seven-storey block of 130 flats, Priory Cres, Prittlewell.—Talbot and White, 34 Clarence St, surveyors for 15-storey block of 95 flats on site of Imperial Hotel, Westcliffe.

South Shields. Newcastle Hospital Board tender: two-storey corridor to link two wards at South Shields General Hospital, George H. Gray and Ptnrs., 52 Camden St, North Shields.

S. Wales. £10 million chemical plant planned by British Hydrocarbon Chemicals Ltd. on site near Llandarcy.

Sunderland B.C. Tender: Major extensions to training college; four-storey hostel block; two-storey teaching block and one-storey communal block and alterations to existing premises. Architect, Grange Hse, Stockton Rd. Tender: 204 dwellings at Hylton Red Hse estate. Architect.

Sutton and Cheam. M. J. Gleeson, London Rd, Cheam, plans 96 flats at Cheam Rd.

Telford. Corporation plans third block of nine-unit factories on industrial estate.

Tottington. Kirklees Ltd. plan factory extensions.

Trowbridge. McCall Bros., Upper Mills, Trowbridge, plan Cradle Bridge Mill new factory building.

Twickenham. Richardson and Houfe, 24 Queen Anne St, W.1, architects for science block, assembly hall, etc., at St. Mary's College, Strawberry Hill.

Tynemouth. Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, architects for factory extensions at Pallion for Industrial Estates Corporation of England, Team Valley, Gateshead.

Wallsend. T.C. plans 20 old people's houses on village green and four at Low Willington Farm at £32,000.

Wem U.D.C. Tender: Two three-storey blocks of flats of 30 units, 18 houses. Architects: Biggins and Assoc., Richmond Hse, 123 Boughton, Chester.

Weston-super-Mare T.C. Tender: Two factories with offices at Oldmixon industrial estate.

Whitley Baw. R. A. Gofton and Sons. Front St, Monkseaton, contractors for Stephens Manufacturers' factory extensions.

Wigston U.D.C. Conversion of gas street lamps to electricity at £14,000 planned.

York. Leeds Hospital Board, Harrogate, plans 500-bed hospital at Bootham.

GAZETTE ANNOUNCEMENTS

BANKRUPTCY ACTS

ing Orders

ingham. S. L. R. Suckling, plumbing electrical contractor, carrying on business Aquatherma, at 2 Chelmsley Grove, Birmmham 33. Receiving order 30 Sept.

gh. R. G. Daniels, electrical retailer, carrying on business as Hayden Television, 53 Oxford Rd, Windsor. Receiving dated 4 Oct.

Meetings and Public Examinations

head. Cirex Appliances, electrical disrns, of 3 Westminster Bldgs, 733 n Rd, Westcliff-on-Sea. First meeting: on, 13 Oct., at 58-61 York Terr, t's Pk, N.W.1; and public examina- 11 a.m., 22 Nov., at 102 London Rd, nd-on-Sea.

ncester. A. C. J. Franklin, electrical er, of 142 Southgate St, Gloucester. meeting: 10.30 a.m., 13 Oct., at Official er's Office, 26 Baldwin St, Bristol; ublic examination: 11 a.m., 14 Nov., re Hall, Gloucester.

astle. G. H. Cornwell, electrical r-carrying on business at 21 Rock- , Pitt La, Bideford. Public examina- 2.15 p.m., 6 Dec., at The Guildhall, aple.

on. N. Pilling, electrical contractor, ag on business at 48 Bury Rd, Rad- . Public examination: 10.30 a.m., 14 at Court Hse, Mawdsley St, Bolton.

by. K. King, electrical contractor and r, carrying on business at 71 Mansfield lfretton. Public examination: 10 a.m., v., at Court Hse, 20 St. Peter's Church Derby.

ford. A. Owen and L. G. A. Shaw, cal contractors, formerly carrying on ss as Owen and Shaw, at Corner Cross Rds, Hixon. First meeting: 1., 18 Oct., at Official Receiver's Office, nsdale St, Stoke-on-Trent; and ublic nation: 2 p.m., 2 Dec., at The Guild- stafford.

ie of Trustee

lverhampton. L. Stanyer, electrical goods dealer, etc., carrying on busi- at 552 Dudley Rd, Wolverhampton. e: R. F. Bendall, 126 Colmore Row, ngham, released as from 5 Aug.

Intended Dividend

Bradford. M. R. Dixon, plumber and electrical contractor, formerly carrying on business at 792 Leeds Rd, Bradford. Last day for receiving proofs for intended dividend: 18 Oct., to trustee: G. E. Rushton, 36 North Parade, Bradford 1.

COMPANIES ACTS

J. A. Phillips (Electrical) Ltd. Meeting of creditors to be held at W. H. Cork, Gully and Co., 19 Eastcheap, E.C.3, on 26 Oct., at 12 noon.

Croydon Electrical Co. Ltd. Mr J. J. Wrench, 17 Bedford Row, W.C.1, and Mr G. A. Wale, Walter Hse, 418-422 Strand,

W.C.2, appointed liquidators on 26 Sept., for the purpose of winding-up.

Electroservice (R. W. Taylor) Ltd. Petition for winding-up to be heard before the Royal Courts of Justice, Strand, W.C.2, on 17 Oct. Persons intending to appear to notify Thornton Lynne and Lawson, 56 Portland Pl, W.1, by 1 p.m., 15 Oct.

Advance Domestic Appliances Ltd. Mr A. Strudwick, 75 Agincourt Rd, N.W.3, appointed liquidator at extraordinary general meeting on 21 Sept. for the purpose of voluntarily winding-up.

Blackvac Eng. Ltd. Meetings of members and creditors to be held at 28 West Sunnyside, Sunderland, on 1 Nov., at 2 and 2.30 p.m., respectively.

MEETINGS TO NOTE

THURSDAY, 13 OCT.

I.E.E. (Utilisation Section). Chairman's address, "Developments in Electrical Plant for Industry," J. M. Ferguson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Southern). "The Measurement of Time," L. Essen. S. Dorset Technical College, Weymouth. 6.30 p.m.

I.E.E. (West Wales). Chairman's address, J. Nelsey. Conference Room, S. Wales Electricity Board, Kingsway, Swansea. 6 p.m.

I.E.E. (Southern Graduates and Students). Chairman's address, "A Review of Modern Computing Elements," R. E. Hayes. The University, Southampton. 6.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (S. Western). "Introduction to Milwaukee-Matic," A. Tack. Technical College, Brunswick Rd, Gloucester. 7.30 p.m.

COUNCIL FOR PRESERVATION OF RURAL ENGLAND. National Conference for Preservation of the Countryside at Weymouth until 15 Oct.

FIRST ELECTRICAL ENGINEERS' EXHIBITION DINNER. Grosvenor Hse, London.

A.S.E.E. (Bradford and District). "Further Discussion on the I.E.E. Regulations," J. L. Brownell and H. F. Smith. Midland Hotel. 7.30 p.m.

A.S.E.E. (S.W. London). "Recent Developments in Luminescent Light Sources," Thorn Hse, Upper St. Martin's La, W.C.2. 8 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Teesside). The Errors of Instruments—Their Study and Importance," H. Kenney. Cleveland Scientific and Technical Institute, Corporation Rd, Middlesbrough. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). "Any Questions," M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Control Section). "Transistor Switches in Monitor and Control Systems," W. A. Ross. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

I.E.S. (Manchester). "Lighting Journey Down the Rhine," E. J. Smith. Demonstration Theatre of N.W.E.B., Town Hall Extension, Manchester 2. 6 p.m.

FRIDAY, 14 OCT.

I.E.E. (N. Staffs). Joint annual dance. Crown Hotel, Stone. 8.30 p.m.

E.P.E.A. (Meter Engineers' Technical Group). "The Post-War Organisation of the Electricity Supply Industry," A. M. F. Palmer. Caxton Hall, S.W.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Midlands). "Fundamentals of Temperature Measurement," E. B. Jones. Lecture Theatre of the Byng Kendrick Suite at the Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS. "Nuclear Fuels," Robin F. W. Guard. Pepys Hse, 14 Rochester Row, S.W.1. 7 p.m.

SATURDAY, 15 OCT.

A.S.E.E. (Liverpool and District). Dinner/dance. Mecca Restaurant, Exchange St East.

MONDAY, 17 OCT.

I.E.E. (Mersey and N. Wales). "Short-circuit Ratings for Mains Cables," G. S. Buckingham and "A Basis for Short-circuit Ratings for Paper-insulated Cables up to 11 kV," L. Gosland and R. G. Parr. Town Hall, Chester. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). Chairman's address, E. D. Taylor. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (Scottish Electronics and Measurement Group). Chairman's address, J. Stewart. Institution of Engineers and Shipbuilders, 39 Eimbank Cres, Glasgow. 6 p.m.

I.E.E. (N. Staffs). "The Shielding of o/h Lines Against Lightning," J. H. Gridley. County Technical College, Stafford. 6.30 p.m.

I.E.E. (W. Supply Group). Chairman's address, Demonstration Theatre, Electricity Hse, Colston Ave, Bristol 1. 6 p.m.

I.E.E. (London Graduates and Students). Chairman's address. Unit Cinema, 3 (Tels) Trng Bn, R E.M.E., Arborfield, Berks. 7 p.m.

I.E.E. (Reading). "The Development of m.c.b.'s for Circuit and Earth Leakage Protection," J. A. Robbins. George Hotel, King St, Reading. 7.15 p.m.

BIRMINGHAM ELECTRIC CLUB. "Electric Traction," J. A. Broughall. Grand Hotel. 6.15 p.m.

A.S.E.E. (Bristol and West). "The Story of the Time Clock," J. Key. Royal York Hotel, Bath. 8 p.m.

TUESDAY, 18 OCT.

I.E.E. (N. Midlands Utilisation Group). "The Design of Electromagnetic Pumps for Liquid Metals," D. A. Watts. Leeds and County Conservative Club, South Parade, Leeds 1. 6.30 p.m.

I.E.E. (Measurement and Control Group). "Development of the Formulae of Electromagnetism in the M.K.S. System," P. V. goureux. Eng'neers' Club, Manchester. 6.15 p.m.

I.E.E. (S.E. Scotland). Sub-centre chairman's address, I. S. Fraser. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

SOCIETY OF RELAY ENGINEERS. "Picture Quality Control Equipment for Wired Television Networks," B. W. Osbourne. 21 Bloomsbury St, W.C.1. 2.30 p.m.

NEW COMPANIES

ated from the Register issued by Jordan Sons Ltd., 116 Chancery La, W.C.2.
old Jackson Ltd., "Linden," Shorter Shenfield, Essex. To carry on business etricians, dealers in electrical apparatus. Nom. cap.: £100. Dirs.: John R. d and James S. Jackson.

ish Insulated Cables Ltd., Norfolk Norfolk St, W.C.2. Nom. cap.: £2. James P. Hourston and Jesse J.

ugh Brothers (Wyke) Ltd., 46 Town- Wyke, Bradford. Electrical, radio and ion dealers, etc. Nom. cap.: £3,000. Walter P. Clough, Mrs Gwendoline h and Arthur V. Clough.

abourne Electric Co. Ltd., 94 Smith- Rd, Liverpool. Nom. cap.: £600. George Easthope, Walter A. Glass eorge H. Hamblett.

stan Ltd., 25 Rayleigh Rd, Thunders- Essex. Electrical engineers and cons- , etc. Nom. cap.: £1,000. Dirs.: W. Standing and Walter Standing.

eral Electrodynamics Co. (of Texas) 5 Gate St, W.C.2. Manufacturers of levers in electrical goods, etc. Nom. £100. Dirs.: to be appointed by sub- rs. Subs.: Hetty Lyons and Geoffrey acs.

in H. Hayter Ltd., 3 Chepstow St,

Manchester 1. Dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Alan H. Hayter, Cecilia G. Hayter and Herbert W. Hayter.

S. A. Moss Ltd., 67 Long St, Atherstone, Warwicks. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Permanent dirs.: Samuel A. Moss and Velma I. Moss.

Northern Electrical Connections Ltd., 31 Booth St, Ashton under Lyne, Lancs. Manufacturers of and dealers in electrical connections for the engineering industry, etc. Nom. cap.: £100 in £1 shares. Dirs.: Frank Newton, Henry V. Hird and Charles S. Douglas.

Smith's Electric (Enfield) Ltd., 134 Chase Side, Enfield, Middx. Nom. cap.: £2,000. Dirs.: Laurence Smith and George Smith.

Streeter and Sparks Ltd., Fern Cottage, Sandy La, West Hoathly, Sussex. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Jesse J. Streeter, Claude A. Sparks and Ronald J. Streeter.

United Power Co. Ltd. To design, develop, assemble, construct, manufacture and supply nuclear reactors and components, etc. Nom. cap.: £100,000. Dirs.: not named. Subs.: Russell F. Syder, Magnet Hse, Kingsway, W.C.2; and Walter L. Adams, 28 Theobalds Rd, W.C.1.

Meetings to Note—continued

INSTITUTION OF CIVIL ENGINEERS. "Zambezi H.E. Development at Kariba: First Stage," Sir Duncan Anderson, T. A. L. Paton and C. L. Blackburn. Gt. George St, S.W.1. 5.30 p.m.
A.S.E.E. (Oxford and Districts). "Industrial Electrical Safety," F. Galloway. Employment Exchange. 8 p.m.

WEDNESDAY, 19 OCT.

I.E.E. (Supply Section). Chairman's address, "The Developing Engineer," J. E. L. Robinson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Sheffield). Chairman's address, "Electrical Contracting in Commerce and Industry," E. J. Lilleker. Grand Hotel. 6.30 p.m.

I.E.E. (N. Lancs). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. N.W.E.B. Demonstration Theatre, Duke St, Barrow. 7.15 p.m.

I.E.E. (S.W. Scotland). Sub-centre chairman inauguration and "A Basis for Short-circuit Ratings for Paper-insulated Cables up to 11 kV," L. Gosland and R. G. Parr. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

I.E.E. (Southern). "A Survey of Street Lighting and its Future," W. R. Stevens and H. M. Ferguson. Technical College, Brighton. 6.30 p.m.

I.E.E. (Southern). "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. A. Satterington. Christchurch 6.30 p.m.

I.E.E. (S. Western). Chairman's address, F. C. Isaac. Plymouth "B" Generating Station, Plymouth. 3 p.m.

I.E.E. (Rugby Graduates and Students). "Transistor Amplifiers," M. W. Dobson. Rugby College of Engineering Technology. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Wales). "The Use of Transistors in Pulse Circuitry," A. R. Owens. Welsh College of Advanced Technology, Cardiff. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Newcastle). "Noble Metal Thermocouples," J. A. Stevenson. The Conference Room, Roadway Hse, Oxford St. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). "Characteristics of Differential Producers for Flow Measurement," H. E. Dall. University of Bristol, Dept. of Physics, The Royal Fort. 7.30 p.m.

A.S.E.E. (Nottingham). "Modern Store Lighting," J. R. Just. Nottingham Mechanics' Institution, Trinity Sq. 7.30 p.m.

A.S.E.E. (Wolverhampton and District). "Breakdown of Electrical Equipment—Some Remedial and Insurance Aspects," F. E. Noakes. Chamber of Commerce, District Bank Chmbrs, Lichfield St. 7.45 p.m.

STERLING CABLE COMPANY LIMITED**Severe Competition Successfully Met****Record Current Order Book****Mr. James S. Clark on Need for Stable Home Market Conditions**

THE 12th annual general meeting of Sterling Cable Company Limited was held on 10 Oct. in London, MR JAMES S. CLARK (chairman and managing director) presiding.

The following is his circulated address: I have the pleasure to submit the Report of the Directors and the Accounts of the Company for the year ended 31 March, 1960.

The Group profit before tax was £53,129 compared with £105,344 last year. Income tax requires £24,628. The Group profit, after tax, is £28,501, out of which we have provided for Preference Share Redemption £5,577 and for the Preference dividend, less tax, £6,284. The recommended Ordinary dividend of 6½%, less tax, will require £16,124, leaving £516 to add to our carry forward, which now totals £68,890.

TRADING CONDITIONS

Last year I told you of the severe competition which had arisen in the industry. This competition rapidly intensified, to the point where the popular types of distribution and consumer cables were being offered at substantially below factory cost.

Steps which we had taken months before to combat this situation met with considerable success. Increased endeavour in markets not so badly affected enabled us to operate on an economic basis and show a final profit. This result reflects the greatest credit on our staff, who cheerfully and energetically worked to overcome the frustrations and difficulties associated with the rapid changes of programme and great flexibility which were necessary to produce a reasonable result in trading conditions which passed from order to chaos in a few months.

Enough has already been written about this undignified period in the industry's history. I earnestly hope and believe that the lessons learned will not easily be forgotten.

THE CURRENT YEAR

To turn to the present—our order book is larger than ever before and is balanced over an exceptionally wide range of cables for Export and Home markets. Prices, although not yet entirely adequate, are becoming more stable and there is every reason to believe that this year will show a return to the fair profit margins hitherto enjoyed. The whole experience of the past year will eventually prove that the prices charged by your Company have at all times been modest and reasonable.

Once again it is a privilege to thank a wide range of customers for the splendid support they have given us during this most difficult year. Their continued confidence gives us all great encouragement.

HOME AND EXPORT MARKETS

May I remind you of another aspect of unstable Home market conditions? As you know, we have at all times worked extremely hard and effectively in the Export market. Competition from European manufacturers continues to increase. This is not surprising. Their efforts are backed by a well-organised and profitable Home market. This enables them to devote practically all their attention to overseas sales promotion.

Unfortunately the exact opposite obtains in this country. Manufacturers are exhorted to devote the major portion of their attention to export fields but, at the same time, are faced by legislation which jeopardises and, in fact, temporarily destroys stability at home. The kaleidoscopic pattern emerging requires day to day concentration, and overseas effort and planning cannot receive its due priority.

I am convinced that a steady Home market is the essential prerequisite of an enterprising export policy. I hope the necessary stability may now, to some extent, be returning.

The report and accounts were adopted.

THURSDAY, 20 OCT.

I.E.E. (N. Midlands). "The Supply Problems," H. Anderson; "The Problems," C. H. Nicholson; and "Problems," A. Minty. Lecture Notes Offices, Fereensway, Hull. 6.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. "The Age of Nuclear Power," Busbridge. Social Hall, Crompton Park. 7.15 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Southern). "Process Planning and Control Systems," A. Tack and J. B. tion of Engineers and Shipbuilders, Cres, Glasgow. 7.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Southern). "Equipment Peripheral Computers," E. J. Petherick. Polytechnic, Southampton. 7.15 p.m.

I.E.E. (Cambridge Electronics and Instrument Group). "Frequency Variation: Oscillators and the Earth's Rotation," the N.P.L. Caesium Standard," L. Es Parry and J. McA. Steele. Cavendish 8 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGISTS. "Instrumentation at the Brit Research Department, Derby," J. H. and A. Kettley. University, Leicester 8 p.m.

FRIDAY, 21 OCT.

I.E.E. (Southern). "The Application of Electronics in Industry," M. C. Crowley-Mi Showrooms, Newport, I.W. 6.30 p.m.

I.E.E. (W. Wales). Annual dinner/dance at Bay Hotel, Swansea. 7.30 p.m.

BIRMINGHAM ELECTRIC CLUB. Ann Grand Hotel.

JUNIOR INSTITUTION OF ENGINEERS. "Management in Small Plants," L. Rochester Row, S.W.1. 7 p.m.

A.S.E.E. (Aldershot and District). "The Aldershot and District," Victoria Hotel.

A.S.E.E. (Liverpool and District). "Power and Propulsion," R. V. Mox Theatre, Chadwick Physics Laboratory, University. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "The Applications in the Electrical Industry," J. H. Davis. Grand Hotel, Hanley. 7 p.m.

MONDAY, 24 OCT.

I.E.E. (E. Anglian). "Electrical Practice," E. J. Sutton. Electric Hse 6.30 p.m.

I.E.E. (N. Eastern). "Safety in the Use of Electricity," S. J. Emerson. Neville gate Rd, Newcastle. 6.15 p.m.

I.E.E. (N. Western). Discussion. "The Students for Appropriate Courses," B nical College. 6.15 p.m.

I.E.E. (S. Midlands Electronics and Instrument Group). "Automatic Control of Assembly Bicycle Parts," A. V way and R. L. Dressler. James Wat Institute, Birmingham. 6 p.m.

I.E.E. (W. Utilisation Group). "Developments in Electrical Industry," J. M. Ferguson. S. Wales Engineers, Park Pl, Cardiff. 6 p.m.

I.E.E. (Sheffield). Chairman's address, "Electrical Contracting in Commerce and Industry," E. J. Lilleker. Angel Hotel, Brigg. 7 p.m.

I.E.E. (N.W. Graduates and Students). "D.C. Variable Speed Drives," Electrical Engineering Department, Manchester. 7 p.m.

I.E.E. (London Graduates and Students). "Southern Region Coast Electrification Scheme—Power Apparatus," Savoy Pl, W.C.2. 6.30 p.m.

TUESDAY, 25 OCT.

I.E.E. (Measurement and Control). "Rapid Methods for Ascertaining V Activity of a Weak Radioactive Sample," E. H. Cooke and R. C. M. Barnes. Savoy Pl, W.C.2. 6.30 p.m.

I.E.E. (N. Eastern). "Safety in the Use of Electricity," S. J. Emerson. Carlisle College. 7 p.m.

I.E.E. (N.W. Supply Group). "The Use of Turbo-alternators," J. R. Hill W. J. Joyce and D. H. Tompsett. English Manchester. 6.15 p.m.

I.E.E. (S. Midlands Graduates and Students). "Stereophonic Sound," K. N. Hav Herbert Hall, Coventry. 7 p.m.

I.E.E. (N. Staffs Graduates and Senior chairman's address, G. H. G Hotel, Stafford. 7.15 p.m.



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In diesem Heft
 Einführung eines Systems von Kälte-Kabeln
 In diesem Heft wird die künstliche Kühlung von Kabeln durch eine zentrale Bohrung des Kabels hindurchgeleitet wird. Der Versuchsanordnung wurde Öl im Kreislauf durch einen 12 mm-Kanal in einem 484 mm²-Kabel gepumpt und dem angeschlossenen Wärmeaustauschgefäß abgeführt. Es stellte sich dabei heraus, dass die Belastung um 75% gegenüber dem natürlich gekühlten erhöht werden konnte. Bei der betriebsmäßigen Anwendung der künstlichen Kabelkühlung dürfte aber die Leistungsleistung die erzielbare Erhöhung der Belastung praktisch begrenzen.

Transformatorbau ... 591
 Gegenwärtig von einer der größten Firmen auf dem Gebiet des Transformatorbaus untersuchten Probleme umfassen u.A. Geräuschverminderung, Stufentechnik, Überspannungsverhalten und die Anwendung von Digital-Rechengeräten beim Konstruieren von Transformatoren.

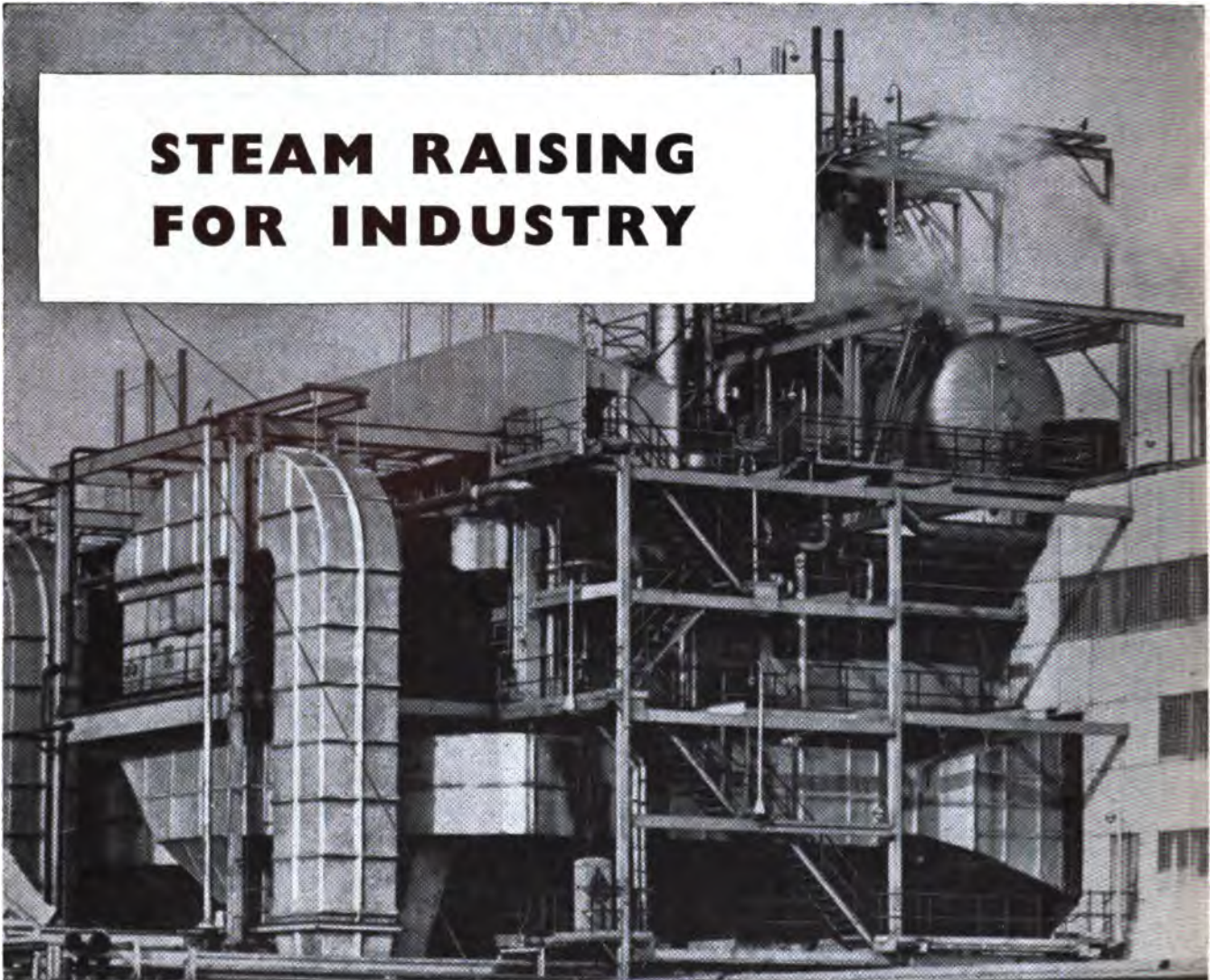
Ergonomie in der Industrie ... 608
 Ergonomie, eine verhältnismäßig neue Wissenschaft, befasst sich mit dem Studium des Menschen in seiner Arbeit bestimmten Umwelt. Eine vorläufige auf drei Tage anberaumte Konferenz war dieser Wissenschaft gewidmet. Sowohl die Maschine wie die Mensch lassen sich planmäßig bestimmen und lenken, die logischen und psychologischen Wesenszüge des Menschen jedoch nicht. Der Ergonomist trachtet die menschlichen Faktoren zu ergründen und daraus praktische Informationen für Konstrukteure und Architekten abzuleiten, die es diesen ermöglichen sollen, das Arbeitsgerät und die äusseren Arbeitsbedingungen so zu gestalten, dass eine Herabsetzung der Ermüdung, der Müdigkeit und des ungenauen Arbeitens und dadurch die Erhöhung der Arbeitsproduktivität erreicht wird.

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IB 11

ELECTRICAL TIMES

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Comment

APPROVAL GETS GOING

The much-needed approval scheme for the safety of electrical appliances is being launched this week, not with a beating of drums, but with a quiet invitation to manufacturers and importers to submit for approval electrical appliances in four specified classes. On this first group, the approvals board of management has committed itself to firm dates and it is expected that the approvals programmes for other appliances will follow at reasonably close intervals. The initial volume of approval work will be greatly eased by the many appliances that have already passed the required tests for inclusion in the EDA list or Kite mark approval, and these will automatically qualify for the new approval mark. What is more, a testing organisation is already in existence and is being expanded to meet its increased responsibilities. Some delay may be encountered by the lack of suitable standards in certain cases, but the real problem will arise when the trade pipe-lines are filled with approved appliances and the new approval mark has to be launched on the public. Experience with the familiar Kite mark scheme has shown that trouble can lurk in unlikely places. However, the public is becoming conditioned to the acceptance of marks, and with an endorsement anticipated from the Molony committee when it eventually reports, the background of success will be there. And succeed the scheme must if the public is to be shown that the industry needs no outside assistance in keeping its own house in order. This will demand sufficient funds to launch the new approvals mark on the public at the appropriate time, and it is now that the planning must be done.

CHANGING PATTERN IN TARIFFS

At this time, when tariff revisions are so much in the air, it is opportune to study how the revenue per unit from different consumer classes has varied over the past few years. A preliminary study suggested the supply year 1951-52 as a suitable starting point. This was the first year in which the current form of annual statistics was introduced and by that year some of the roughness of pre-vesting prices had been ironed out. By a coincidence, the estimated normal load factor for that year was the same as for 1959-60, although due to load cuts the actual figure was some 4% higher. Since 1951-52 the highest percentage increase in revenue per unit, 27.1%, is for energy sold to industrial consumers, part of which must be attributed to the fall in load factor. The increase on domestic units has been 24.7%, while the lowest increase is that for commercial consumers, 17.2%. Naturally, wide differences exist between the individual area boards, but today, in all consumer

classes, there is less variation between area boards in revenue per unit than eight years ago. Over this period, also, in actual units sold, domestic shows the greatest percentage increase, with commercial as a poor third in load growth. Interesting as these figures may be, it is unwise to draw firm conclusions from them as they represent an isolated period in a continuously changing pattern of prices. None the less, it is difficult to avoid the conclusion that commercial tariffs have not kept pace with those of other consumer classes. Indeed, in the case of South Wales, the commercial revenue per unit was actually less in 1959-60 than in 1951-52. There seems little justification for this falling behind of yield on commercial units; it is a factor that could be kept in mind when tariff changes are contemplated.

LEGISLATION TO BOOST AVAILABILITY

Development of techniques for speeding overhauls, and better information about the time for which plant may be left between overhauls, have done much to step up availability of power station plant when it is most wanted. One of the limiting factors in this drive to increase availability of generating plant during the winter months of potential peak demand is the maximum interval laid down by statute between inspections of boilers. During the war, and since, power station boilers have been exempt from the Factory Acts' hampering inspection-every-year requirement. In the future, if the Minister of Labour accepts the recommendations of an expert committee which reported last week, the period between inspections will be extended from the present 18 months under temporary arrangements, to a permanent 26 months; effectively, every-alternate-year inspection. Further, the same provision is recommended for the heat exchangers of the nuclear power stations at present under construction for the generating boards. These decisions of the committee will be welcomed by the supply industry for the flexibility in planning they bring. It is notable that they are occasioned not so much by any inherent superiority in large boilers, but rather by the confidence that the electricity boards and the large industrial undertakings, which alone operate large boilers, pay the closest attention to maintenance and operating techniques and to the preservation of the highest standards of water purity, points to which the committee attach particular importance. Indeed, they specifically recommend training of boiler operatives and note with obvious regret that it is only variations in circumstances from installation to installation that prevent them from making recommending regulations covering feed water purity.

KEEPING TRANSFORMERS QUIET

There is increasing concern amongst the public with all aspects of noise, and the generally quiet electrical industry suffers from the increased sensitivity which results. Currently, there is concern about trans-

formers, both in the distribution networks and in large substations. Use of cold-rolled, grain-oriented steel for cores, with lower losses making possible higher flux densities, is accompanied by more magnetostriction, and increased noise is the result. In the fundamental work on the problem being carried out by one manufacturer, whose works we visited last week, the outstanding problem thrown up is the variability of batches of steel strip all of the same nominal grade. The subject is complicated, as dim memories of physics experiments remind us, by the variation in sensitivity of the human ear to sounds of different frequencies. Transformer core vibrations at harmonic frequencies can be far louder for a given energy or sound pressure level than those at the fundamental. Until transformer steel makers find some means of making the cold-rolled product homogeneous in its magnetic properties, or at least of controlling variations, the more elegant approaches to noise suppression are not available to the transformer manufacturer. However, despite the unfortunate effectiveness of oil as a noise transmitter, there are some useful ideas coming into service for economical enclosures and the avoidance of fortuitous amplification of noise due to particular forms of mechanical construction. These should keep noise nuisance down at reasonable economy and avoid the position where the public imagine every transformer is noisy because of what they have heard of a few isolated, well-justified complaints.

NATIONAL PRODUCTION FOR GAS

The 1959-60 annual report of the Gas Council is not so ebullient as those of a few years ago. Two years of deficits can have a damping effect, particularly when most percentage growth figures are negative. None the less, the industry is planning ahead and the most significant factor is the setting up of a production policy committee responsible for planning gas production on a national basis. This follows from the new methods of production that are being developed by the Council as well as new sources of gas, which will require a scale of operation beyond the needs of individual gas boards. Such techniques will clearly demand the building of the long-discussed gas grid. One of the factors is the direct import of methane which has been proved possible technically. Studies of the economics are now being made and these appear sufficiently good to capture the interest of the Royal Dutch-Shell oil group. On the selling side, the increasing use of gas in industry is the main bright spot of the report, but great things are hoped from ducted heating systems, which are the gas industry's reply to electric floor-warming. Operating experience on trial installations is reported satisfactory and some 2,000 flats in course of construction will be provided with this method of heating. So the gas industry still shows the commercial resilience that should keep electricity on its toes.

This week's quick summary of electrical news faces advertisement page 20

Meteor

An experimental oil-cooled cable system

by S. C. Chu,* B.Sc. (Eng.), A.M.I.E.E.

ARTIFICIAL cooling has been applied to many types of electrical machinery, and it is quite common for alternators and transformers to achieve very ratings coupled with high efficiency in the use of oils by this means. Owing to the continuous increase in power demand, cable engineers have been devoting attention to the use of forced cooling of power cables in order to overcome the difficulties due to limited space and similar factors; that is, to permit transmission of more energy with a given cable size.

At power stations and substations, where very large amounts have to be considered, it is often necessary to install large groups of cables within confined spaces. Installation of numerous terminations, and supports, can be a serious problem. In securing a solution, safety margins must be reduced through severe bends, high ambient temperatures, mutual heating, and increased risk of damage during maintenance, etc. Where several buried cables converge on to a station, costs are increased considerably by the allowances which have to be made in copper conductor sections, because of mutual heating. In extreme cases, up to three times the normal conductor cross section may be required.

In underground cable systems, load capacity of the cables can be increased during peak periods or the number of cables can be reduced with artificial cooling. Also, where there is large variation in soil thermal resistivity along the cable route, the possibility of "hot spot" temperatures must not be entirely overlooked. Artificial cooling can alleviate this problem.

A variety of cooling methods have been experimented with and applied to power cables.

Cooling Techniques

Artificial cooling of cables has been considered more fully by a number of investigators since 1951. Their methods can generally be divided according to whether the coolant is introduced externally to, or internally into, the dielectric (Fig. 1).

For the external cooling, Burrell, Falcone and Roberts¹ studied forced-air cooling of station cables in ducts, and a few practical applications have resulted in the ability to overcome rating limitations in existing cable installations.

Burrell² has developed a number of practical formulae and graphs for calculating the temperature at any point along a cable route using different methods of cooling pipe cables or cables in ducts or in tunnels.

Barro³ introduced the term "thermal efficiency" to assess the relative merits of different cable installations by averaging. In his recent paper⁴ mathematical and experimental investigations were given on temperature rise of

cables of 1 to 15 kV installed in large gallery cooled by forced ventilation.

Gillette⁵ has found that by circulation of oil in a 200 yd length of 69 kV pipe-type cable and through an air-cooled heat exchanger, the number of cables can be reduced from three to two.

Brodicty⁶ has described two installations of 12 kV and 66 kV, respectively, in which water was forced through the ducts in which the cables were installed, and no adverse effect on the cable sheaths was found.

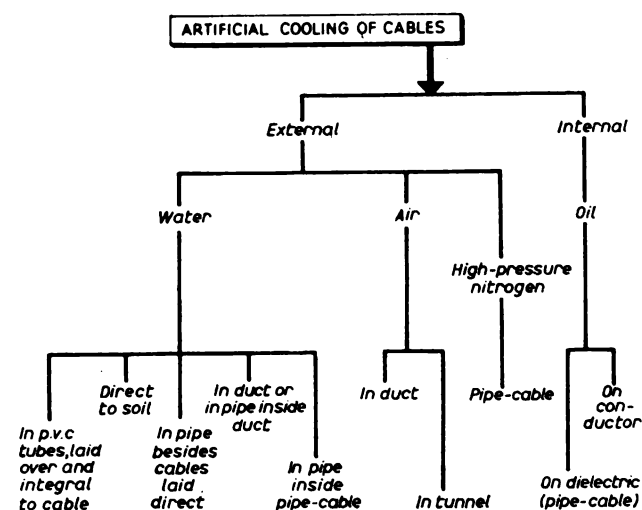


Fig. 1. Suggested techniques for artificial cooling of power paper cables

Several attempts have been made successfully to reduce the "hot spot" temperatures owing to variations in soil thermal resistivity along the cable route. Fink has studied the use of backfill in place of soil known to have poor thermal properties.⁷ Lowering of thermal resistance by continuous moistening of the surrounding dry soil can obtain a reduction of 10° to 15°C of the cable.⁸ Automatic oscillation of oil back and forth over a 200 yd 138 kV pipe cable by differential pressure system using float switches is also found practicable in lowering "hot spot" temperature.⁹ For pipe-type compression cable, circulation of gas has been applied recently in Canada to eliminate the "hot spot" temperature.¹⁰ In this case the conductor temperatures along the entire route of about ½ mile can be evened out to within 5°C, as indicated by a temperature telemetering system.

Circulation of water through polythene pipes laid alongside 115 kV oil-filled cables laid direct in the ground has been applied recently in Canada, thus increasing the current rating of the cable by 50%.^{11,12} Similar order of rating improvement is also possible on 275 kV pipe-line cable greater than 1 km length cooled by water, as discussed in a recent paper by Sutton and Morgan.¹³

In this country, small p.v.c. tubes of segmental shape laid over the reinforced tapes of 132 kV oil-filled cable have been used for passing through cooling water in

* Mr Chu was formerly with Standard Telephones and Cables Ltd. and is now with Enfield-Standard Power Cables Ltd.

order to increase the rating of the cable.¹⁵ It is claimed that 50% increase above the normal load can be obtained.

In the systems described above, the major heat source is separated from the cooling medium by the relatively high thermal resistance of the cable insulation.

The media considered for such methods of cooling are air, water or oil. For cables in ducts, water cooling is a more effective cooling medium than air. The disadvantage is that it is likely to be costly and difficult to install, and may eventually cause corrosion or even erosion troubles.

Circulation and cooling of the pressure medium in a pipe-type cable is more effective with oil as heat transfer medium than with high-pressure gas.

It is evident that, for relatively short cable lengths, the most effective method of cooling should be to remove the heat directly from its main source of generation, i.e., by circulating coolant internally directly onto the conductor. For oil-filled cables, this can conveniently be achieved by circulating cooling oil through the central duct. Experiment on an internally-circulated-oil-cooled cable system was first pioneered in 1951-52 in this country, based on a 11 kV typical power station installation. The basic experiment and the practical design of a proposed installation¹⁶ described later will form the principal theme in the present article.

Since then the application of similar technique was extended to extra high voltage oil-filled cables up to 500 kV.^{17,18} With the circulating oil degasified, the cable dielectric strength can be improved by eliminating any gas evolved.

Internal water circulation in plastic cables with a hollow core conductor for loading heavy currents from generators to generator/transformers and for carrying large currents associated with nuclear apparatus has also been investigated recently.¹⁴ Owing to lower dielectric strength of the plastic insulation, the thickness will be greater than that of impregnated paper for the same working voltage.

Preliminary Considerations for Internal Cooling

Initially, the conductor size of an internally-circulated-oil-cooled cable should be chosen with reference to electrical, mechanical and economic considerations.

Electrical design will usually limit the maximum working conductor temperature to 85°C and the maximum temperature during a short-circuit to 120°C. Since such cables will usually be installed close to alternators, the short-circuit rating may often be the determining factor; in such cases it may be preferable sometimes to reduce the maximum conductor working temperature to a value below 85°C. Fig. 3 shows the variations in short-circuit rating for a typical cable at different maximum conductor working temperatures.

It is to be noted that any reduction in copper cross section will increase the losses which, together with the power consumed in the cooling system, will result in higher operating costs.

Mechanical considerations will dictate the choice of cooling duct size to ensure a reasonable pressure drop along the cable length. The maximum cable internal pressure is usually limited to 15 lb/sq in. for a cable without reinforcing over its sheath, and to about 75 lb/sq in. for an ordinary reinforced cable. A lower pressure drop, i.e., a lower fluid resistance of the duct is to be preferred, since it permits the use of a simple centrifugal pump in the cooling system.

It is now necessary to calculate the quantity of oil flow required through the central duct at any load for a given

conductor section, length of cable and pre-determined inlet and outlet oil temperatures at any ambient temperature. The theoretical cooling equation can be derived by equating the heat generated in the cable with the heat dissipated radially to air through the dielectric and the heat removed by oil flowing axially through the duct.

Thus:

$$q = L / [hG \log_e \{ (wG + T_a - T_1) / (wG + T_a - T_0) \}]$$

where q = Quantity of oil flow, litre/sec.

L = Length of cable, cm.

h = Specific thermal capacity of oil, watt/sec/litre/°C.

G = Total thermal resistance, internal and external to cable, °C watt/cm.

w = Average total loss of cable, watts/cm.

T_a = Ambient temperature, °C.

T_1 = Inlet oil temperature, °C.

and T_0 = Outlet oil temperature, °C.

Pioneer Experiment

An experiment was made to confirm the method and calculations based on an installation in an actual power station to which the system seemed economically suited. There were 24 1.25 sq in. 11 kV single-core solid-type cables serving a double alternator set. The full load current of each alternator was 1,445 amp. The arrangement was two cables in parallel for each phase, and phase to neutral. As the space was congested it was difficult to employ satisfactory cable terminations. Oil-cooled cables of small cross section were suggested as a replacement in order to reduce the number of cables required by half, i.e., one oil-cooled cable to replace the two solid-type cables. By using cables of the oil-filled type, a much higher electrical factor of safety would also result. The ambient temperature was 35°C.

Initial calculations indicated that 12 single-core 0.75 sq in. internal-circulated-oil-cooled cables would be suitable. With copper conductors such cables would carry about 60% of the full-load current without artificial cooling. The normal 0.2 second short-circuit rating of this cable is 81,000 amp based on a maximum conductor working temperature of 85°C, and maximum conductor temperature under short-circuit of 120°C.

A basic experiment was carried out on the 0.75 sq in. cable with a 12 mm central oil duct, and with about the same length as the actual cables required. The cables were installed in trefoil formation in a high ambient temperature, similar to that obtaining on site. The ends were suitably terminated to permit an oil feed into the hollow conductors.

The hot oil leaving one end of the cable was passed through a heat exchanger and an oil filter, and returned to the other end via flow-measuring meters. A pressure tank was used to accommodate the expansion of oil in the system and to provide a basic pressure which, during the test, was 10 lb/sq in. In the experiment, cooling water was supplied direct to the heat exchanger from the town main, but alternative means of supply could, of course, be used in the actual application, such as tapping from an existing condenser circulating water supply.

The tests were made with the oil inlet and outlet temperatures maintained as nearly as possible to 50°C and 85°C, respectively; the latter was fixed by the usual maximum conductor working temperature for this type of cable, and a 35°C drop seemed a reasonable one to expect from a heat exchanger. The loads were varied between 1,200 and 1,600 amp and the rate of oil flow and water flow in the heat exchanger adjusted to obtain the above oil temperatures.

It was found that the actual values of oil flow required agreed fairly closely with the calculated values as shown in Fig. 2. Owing to the limitation of the pump used, the maximum oil flow obtainable was 2.8 litres/min/cable which corresponds to a current loading of 1,600 amp. It should be noted that the limit of streamline flow (i.e., that the Reynolds number is less than 2,000) is about 5 litres/min/cable. Had this flow been applied and the cable loaded to 1,445 amp as required under the actual operating conditions, the maximum conductor temperature could have been reduced to 65°C and the short-circuit rating of the cable thereby increased by about 25%. It is to be noted that this result can also be achieved by reducing the inlet oil temperature.

The maximum permissible length of the cable based on streamline oil flow limit of 5 litres/min/cable is 68 yd, which is far in excess of the route length required for the particular installation.

It can thus be concluded that within the limitations of the testing facilities, the current-carrying capacity of the 0.75 sq in. cable can be increased to 1,600 amp by internal oil circulation, i.e., about 75% over its current rating with natural cooling, with still a considerable margin in hand.

Proposed Installation

A practical scheme was designed for the alternators in question based on the principles employed in the experimental project, and with the addition of the usual protective devices. The arrangement of the oil circuit is shown diagrammatically in Fig. 4. Duplicate pump/cooler units are provided against the event of failure and to avoid shut-down during servicing. The motor pump units are of the centrifugal type, hermetically sealed, with the motors designed to run in oil.

A copper pipe of 1 in. diameter conveys oil to the alternator ends of the cable, and the flow in each branch is adjusted initially by a metering valve to give the same outlet temperature at the remote end of each branch. Similarly, oil is delivered into the neutral cables. A "snap" type thermostat is fitted to each cable sheath at the outlet points to give an alarm should abnormal temperature rise occur due to a restriction in the oil feed.

The system operates at a static pressure of about 10 lb/sq in. without load, and control is by pressure rise in the system, this pressure varying with the cable temperature within limits which can be determined by the pressure/volume characteristics of the static pressure tank. The first pump is therefore set to operate at the designed maximum temperature, and the second one a few degrees higher. Operation of the second pump gives an alarm indicating that the first pump has failed to start, or that an abnormal temperature rise has occurred. Separate oil and the water coils are used in the cooler, and cable oil is used as the heat transfer medium. Any leakage from the system will result in operation of the low oil pressure alarm and leakage from either the oil or water coils in the cooler will raise the pressure of the surrounding oil, which does not form part of the main system and will operate the high pressure alarm incorporated in the cooler. If additional safeguard is deemed necessary in the cooler, an electrical leakage detector has been evolved which indicates traces of moisture in the oil.

Cost

As with any other systems of artificial cooling of cables, an internal-circulated-oil-cooled cable system involves extra cost due to oil circulating pumps, coolers and ancil-

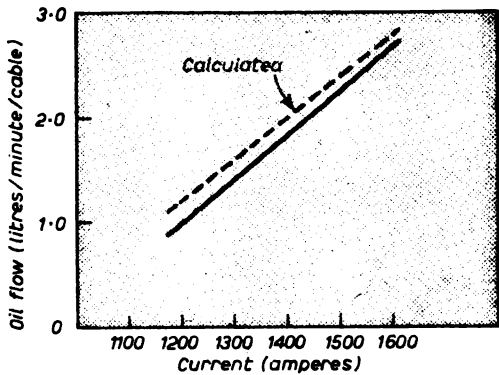


Fig. 2. Experimental results with an internally-circulated-oil-cooled cable with 0.75 sq in. copper conductor. In the tests oil inlet and outlet temperatures were maintained at about 50°C and 85°C, respectively

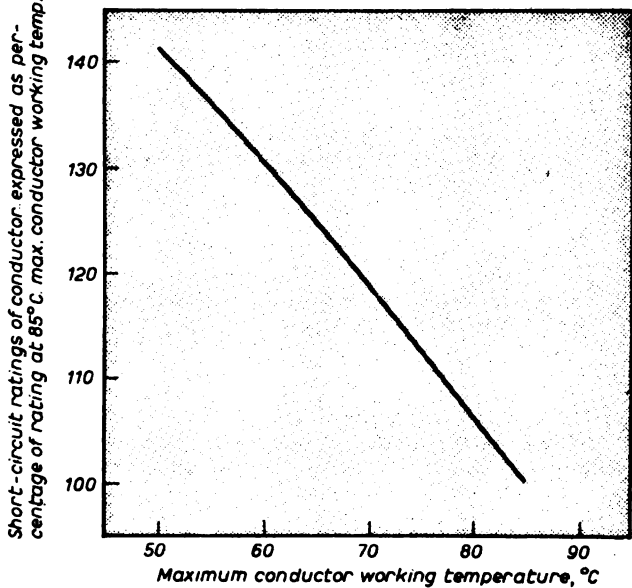


Fig. 3. Comparison of short-circuit ratings of conductors at various maximum conductor working temperatures. (Note: maximum conductor temperature during short-circuit is taken as 120°C)

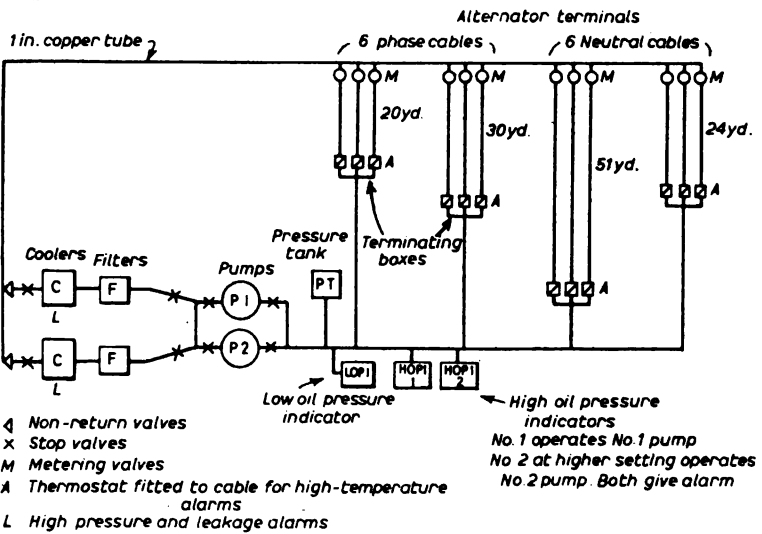


Fig. 4. Proposed oil-cooled cable system for typical 11 kV alternator installation

lary equipment, but this will normally be largely compensated by the reduction of cable costs. Exact comparison will depend on individual cases and requirements and current relative material costs.

Acknowledgments are due to Enfield-Standard Power Cables Ltd. for permission to publish this article.

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Australian concern over U.K. Plant Deliveries

A WARNING that Britain would lose valuable contracts for electrical plant unless prompt delivery could be guaranteed was made by Sir Eric Harrison, High Commissioner for Australia, proposing a toast to the electrical industry at the Electrical Engineers' Exhibition dinner last Thursday. He pointed out that with the rapid industrialisation of the eastern provinces of Australia, demand for electric power was increasing by about 15% a year. To meet this demand the Australian supply industry had to work to a strict time-table. For this reason they could not afford projects to be held up by late delivery of plant.

BEAMA Replies on Late Deliveries. Referring to the Australian High Commissioner's speech at the Electrical Engineers' Exhibition dinner, BEAMA have issued a statement saying that Sir Eric Harrison was doubtless referring to that part of the Snowy Mountains hydro-electric project when completion was delayed owing to civil engineering difficulties. As a result of these difficulties the delivery dates for electrical equipment were revised and the company responsible for supplying the main generating plant complied with the revised dates.

There had been cases in the past of vital supply reinforcement schemes, such as the Snowy River project, being delayed by late arrival of plant from British manufacturers. Sir Eric quoted two examples, one where delivery was six months overdue and the other as much as 18 months. This tardiness compared unfavourably with the record of continental suppliers, whose deliveries, if anything, were ahead of schedule.

Potential Australian Market

Looking to the future, the High Commissioner went on to say that Australia was a large country with an enormous industrial potential. Here was a market in which the Australian Government was anxious for Britain to have a fair share in competition with other countries. There was, for instance, a 760 MW generating station for which contracts will be placed at the end of this year. The decision as to who will get these contracts will depend largely on the delivery question, as it will for contracts covered by a further £13 million expenditure on the Snowy project planned for next year.

Replying to the toast, Mr F. H. S. Brown, deputy chairman, CEEB, admitted that the Generating Board had also suffered from late delivery of plant by British

manufacturers, but that over the past two years the situation, in this country at least, had improved considerably.

Continuing on a different note, Mr Brown said that the CEEB as a monopoly buyer had a joint responsibility of not only supplying electricity to the country as cheaply as possible, but also of ensuring that British manufacturers were kept in the van of generation progress. To achieve this aim the Board was actively pursuing every line of technological advance. Thus, by keeping pace with these advances, British manufacturers would be in a strong position to supply the needs of overseas countries for the latest equipment.

Exhibition Prospects

Speaking of the future expansion of the Electrical Engineers' Exhibition, Mr R. F. Mathieson, chairman of the exhibition company, said that this was limited by the space available at Earls Court. The exhibition had grown to such an extent since its inception ten years ago that there was actually a waiting list for stand space for the 1961 event. With progress made by ECM and its possible integration with EFTA, there might well be a demand for a truly international exhibition in the future. This was clearly impossible under the existing arrangements at Earls Court, and in any case the organisation of an exhibition on such a scale was rather beyond the scope of private enterprise. It was more a matter to be taken up by central government in co-operation with local authorities. Referring to the dinner, Mr Mathieson said that its purpose was to give advance publicity of the exhibition to both potential buyers and exhibitors.

Plea for H.P. Stability

Concluding the after-dinner speeches, Mr W. J. Bird, chairman of BEAMA's Domestic Appliance Division and a director of GEC, expressed the view of British manufacturers concerning h.p. They were not demanding complete lifting of restrictions but they did want freedom from Governmental chopping and changing of h.p. policy. Mr Bird suggested that optimum h.p. terms acceptable to the appliance industry might be 10% down with 3 years to pay. Turning to future trading prospects of the industry, he saw no reason why annual turnover should not be trebled to reach a ceiling in the £1,000 million region. Finally, Mr Bird paid tribute to the successful growth of the exhibition, but pointed to the danger of its original conception being stifled by it becoming too unwieldy.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Responsibility on Sites

FURTHER to *Megohm's* comments on possibility of general contractors in the ELECTRICAL 6 October, the 2½% discount allowed to the main contractor in accordance with the RIBA contract is not used to cover any services or attendance. It is purely payment for cash, that is, payment within 30 days. This is generally understood by electrical contractors and on many occasions I have known them complain over not in payment and have always advised them that they are fully entitled to refuse the 2½% discount if they do not receive payment within the stipulated time.

The above requirement applies to all nominated subcontractors and there is a similar obligation on the part of nominated suppliers, but in this case the cash discount is

omitted, cutting away, unloading, etc., ought to be included in the Bill of Quantities. The specification should specify precisely what the general contractor's responsibilities are and a copy should be sent to the quantity surveyor so that they may be measured or allowed for in the contract in some way.

As this item has been included for this work in the Bill of Materials, the general contractor is quite entitled to refuse to carry it out, unless he is paid for it. Although the position should be quite clear, many people do not read the small print in the contract.

In the exceptional case mentioned, where the general contractor has cut through conduit and refused to pay for the repair, it can be dealt with only by the electrical contractor refusing to carry out repairs unless the general contractor undertakes to pay for them. If the electrical contractor withdraws labour and the main contract is held by the general contractor and not the electrical contractor, who is primarily responsible to the employer.

P. Jay, M.A.,

PETER JAY AND PARTNERS LTD.,
LONDON, W.1.

Helping Contractors and Electrical Work

READING *Megohm's* comments on the need for co-operation between building and electrical contractors on a site brought to mind a visit recently paid by my son's new house at Guildford. He has been having considerable trouble in getting the clerk of works to identify various faults connected with the building, but has had similar experiences in my younger days, I was surprised to indicate other matters which required attention.

There is a strong trend to ensure that the electrical work on new buildings shall be well done and safe. If, however, the builders' men adopt the apparently fairly common attitude of "I couldn't care less" (I have noted it in the north as well as in the south) and the contractors are permitted to shoddy work, the better work of electrical contractors will be nullified and they will be included in the complaints about the building.

There are not some way in which the really good man is protected from becoming involved in the shoddy work of others? "Control" is an unpopular word. Yet it is a word which saves lives! The selfish driver hates control and, unfortunately, we still retain our policemen and the

laws to curb his selfishness. So why not control over bad workmanship, which is, in practice, pure swindling! Could not the powerful electrical trade and its associations campaign unitedly against becoming involved in ways such as *Megohm* has mentioned?

J. W. McDonnell,

STOCKPORT, CHESHIRE.

Electrode Boilers for Offices

A RESUME of the CEBG report on heat pumps and cost of heating in power station office blocks was published in your issue of 8 September, but without comment on the figures produced.

The figures and conclusions on the heat pump show what one might expect, and the real case for the heat pump would be for off-peak use in conjunction with an electrode boiler and thermal storage.

On the figures produced for electrical heating by floor-warming and electrode boiler with thermal storage, the committee should release further information to show the make-up of the annual running and operating costs.

The figures given in the full report of the CEBG committee, for electrical heating by floor-warming and electrode boiler with thermal storage, do not show in full the make-up of annual running and operating costs. Indirect calculations* throw serious doubt on the overall figures derived, and reproduced in Table 3 of the ELECTRICAL TIMES summary.

For a floor-warming system, the figures imply an annual consumption of nearly 3,000 kWh/kW of calculated heat loss, whereas experience shows the consumption is usually in the region of 2,240 kWh/kW. In the case of the electrode boiler with thermal storage, the figures seem even more ludicrous. Instead of the figure of £2,862 for annual operating costs quoted, on a basis of the maximum possible calculated consumption the annual operating cost including capital charges should be less than £2,000.

It would seem that the committee chose a building where the electrode boiler and thermal storage plant were housed in a separate boiler house away from the building to be heated, and this seems a foolish comparison with a building where the heating plant is contained in that building. It is like trying to compare the economics of a machine tool with a self-contained electric drive, with a machine tool driven by belting from overhead shafting with a motor some 100 yards away.

In their conclusions, the committee state: "For the ordinary run of commercial buildings of sizes in the range 200,000 to 500,000 cu ft, off-peak directly embedded electrical floor-warming compares favourably in overall annual operating costs with any other form of heating." For office buildings occupied eight to ten hours per day the committee's conclusions cannot be substantiated. This would appear to be outside their terms of reference, as commercial buildings such as office blocks are not generally heated 24 hours per day, and their statement is erroneous and misleading.

* Mr Edwards has sent us the full calculations supporting his argument, which are too lengthy to reproduce here. He also gives supporting calculations based on experience with an electrode boiler for heating the North Eastern EB offices in Newcastle.—EDITOR.

Any new projected CEBG offices which only require heating during normal office hours can be heated much more cheaply by electrode hot-water boiler and thermal storage than by embedded floor-warming. On the figure of 448,000 B.Th.U's per hour the unit consumption for hot-water thermal storage for heating ten hours per day, five days per week, should not exceed 125,000 units during the normal heating season. The cost at 0.85d per unit would be £443 plus capital charges and maintenance.

To delete the electrode boiler without thermal storage because it is "on-peak" load is a little unfair to the South of Scotland Electricity Board where their off-peak No. 2 tariff accommodates such loads. The storage is in the pipework and radiators and allows a two-hour restriction on peak period twice per day.

J. C. Edwards,
DIRECTOR, BASTIAN AND ALLEN LTD.,
HARROW, MIDDLESEX.

Isolators for Fault Closing

IN your editorial article concerning isolators, on page 506 of 6 October issue, you rightly point out the possible danger of using isolators for reclosure of circuits. If the practice is widespread—and it seems to be common in medium and h.v. operation—the simplest remedy is to incorporate fault-closing as a requirement and a test duty under BS 3078. The electricity supply authorities, in the UK at least, have for many years been aware of the necessity for medium and h.v. isolators to have fault-closing capacity, and they have insisted on the point to manufacturers. In consequence, many of the isolators on overhead transmission lines in this country are capable of fault-closing.

For the sake of safety it may be that all isolators ought to be capable of fault-closing as a matter of course. In that case we would support a change to the standard specifications. We would not welcome another new term, "isolating switch," into this field whose terminology is far from simple and not at all standard.

D. A. J. Oxley,
M.M., ASSOCIATE I.E.E., M.I.PROD.E.
MANAGING DIRECTOR, SWITCHGEAR AND EQUIPMENT LTD.
BANBURY.

Switches for the Aged

I AM in complete agreement with the remarks and suggestions made by *Megohm* in last week's ELECTRICAL TIMES.

There was an old lady who lived in a small bungalow at Witcombe in Gloucestershire; this bungalow was one of a group built specially for old persons. She was an old friend of my family and one day, on a visit, I found that, if anything, the sockets and switches were sited more inconveniently than one usually finds.

The sockets were fixed right near the floor, there was no switch and I was very angry to see this poor old lady fumbling about pulling plugs in and out in order to disconnect an appliance or a lamp.

In addition to the foregoing, the cooker control unit and the main switch were out of reach, but it is doubtful if the old lady would have had the strength to operate them had they been within reach. In the bedroom was a centre light, controlled, if my memory serves me, from the adjoining living room; a socket (unswitched) on skirting board; no bedlight; no provision for controlling the solitary centre light from the bed.

Owing to the sparseness of sockets, she was obliged to use one of those iniquitous socket-adaptors—one of the pests which the ring system was designed to obviate, so we were told.

I see no reason why sockets should not be fixed 18 in. from the floor, this would preclude stooping (almost), but there is a good case for maintaining switch height at 4 ft 6 in. or even slightly higher, especially where surface type is concerned, for it is possible to give oneself a nasty jar when passing someone in a narrow corridor, etc. Also, at that height they are safe from being damaged—or obscured—by chair backs. But for these reservations, I would rather have them at elbow height (3 ft 6 in.).

R. St.C. Ison,
CHELTENHAM.

Boiler Inspection Recommendations

EXTENSION to 26 months of the interval between statutory inspections of power station boilers is recommended by the Ministry of Labour Advisory Committee on the Examination of Steam Boilers in Industry (the Honeyman Committee) which reported last week. The five-man committee is in general agreement that although the existing 14-month period should be kept for smaller boilers, an extension to 26 months should be permitted for water tube boilers of more than 50 klb/hr capacity and also for boilers of 25 klb/hr rating where the total capacity of all such boilers on one site exceeds 100 klb/hr. Four members of the committee wanted to make the extension automatic, but one thinks it should be subject to approval by H.M. Chief Inspector of Factories.

The committee was set up in 1958 to consider existing legal provisions for the examination of steam boilers in the light of modern developments and also with reference to nuclear installations. There has been an every-14-month requirement for boiler inspection since the 1901 Factory Act, but during the war years the extension to 18 months was permitted for certain specified types of boiler. Large power-station boilers were amongst these, and the extension has continued in various forms since. The 1959 Factories Act did not include specific requirements for boiler inspection, but made provision for the Minister of Labour to make regulations governing boiler examination.

Evidence before the committee supported the idea that all boilers to which the Factories Acts apply should be thoroughly examined within 14 months of coming into use. The committee feels that for smaller boilers annual inspection (implicit in the 14-month period) should continue, but that evaporative capacity was a reasonable criterion for deciding which type of boiler merited relaxation. There is agreement that 50 klb/hr sets a limit above which boilers are likely to be used only by the CEBG and other large industrial concerns. These may properly be expected to maintain the high standards of maintenance and operation and feed water conditioning which will be required for every-other-year inspection.

Apart from the recommendations noted above, the committee suggests an initial inspection of all boilers between eight and 14 months after initial installation. In addition, the 14 months inspection interval should apply to all boilers after they are 21 years old.

On the question of nuclear power stations, the committee recommends that the 26-month interval after the initial inspection should apply to the heat exchangers on the power stations now being built for the electricity supply industry. Requirements for more advanced types should be the subject of discussions between the Ministries of Labour and Power, and the UKAEA, before the necessary licence is granted for operation of the station.

Progress in transformer design

E. Co. £3 MILLION WORKS

STRUCTED and equipped to manufacture power transformers up to the largest sizes envisaged in the coming years, the new English Electric transformer works at Stafford was last week shown to engineers from abroad and overseas attending an EE Co. symposium on transformer design. The new factory covers 245,000 sq ft and cost £2 million to build and £1 million to equip. It also includes a 40,000 sq ft four-floor office block providing ample accommodation for design and commercial work.

Work for the new factory was commenced in 1955 and was started in 1957. Up to the time the factory was opened, the largest units manufactured had been 120 MVA transformers. Now the range shown in Table 1 is planned for the next decade. Transportation difficulties due to the physical size and weight of transformers led to the new factory was designed with this in mind, and it is decided after workstudy that provision of a facility to lift 400 tons 60 ft high would give an ideal layout for manufacture and testing with minimum wasted effort in shifting the transformers. The basic concept is that large transformers should be built at one site and then lifted complete with no need for any other transformers in the shop to the area.

Present form the factory is self-contained except for metal-cutting operations, which it was decided to leave because of the danger of metal particles getting into the oils. The only metal-cutting carried out is the cutting of the core steel and a few special processes carried out in enclosures with walls going up to the roof. The factory is divided into six bays, one of which is specially equipped with two 200-ton cranes, which are capable of handling the largest transformers and can achieve most lifts separately. There is another building for erecting smaller transformers. Both these buildings have ready access to test facilities for heat runs and type tests.

Generator

At the end of the high bay is the impulse generator, recently built at Stafford by EE Co. staff and claimed to be the highest voltage (4,800 kVp) in Europe, and the largest energy (346 kW-seconds) in the world. The impulse generator uses the Marx circuit and the design object was to give the generator inductance to a minimum to give the possible range of impulse wave front time. In practice, this has meant combining the lowest number of stages with a high operating voltage, and the generator as built has 12 stages charged at the high value of 400 kV.

The 12 stages has an individual capacitance of 100 farads in three capacitors in parallel. Charging is accomplished by a transformer feeding a voltage divider circuit, controlled in turn by a magnetic amplifier and a feedback circuit from a resistance divider on the output line.

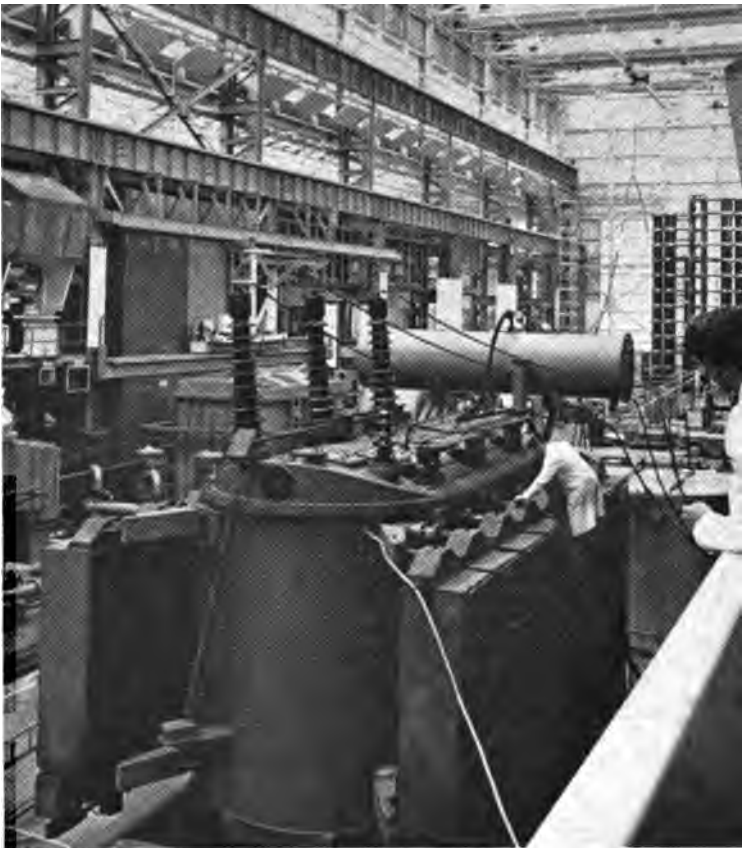


Fig. 1. 200 MVA transformer being prepared for test in high bay at new EE Co. works; 4.8 MV impulse generator in background

Setting up the generator for test is facilitated by use of a recurrent surge generator constructed as an analogue of the impulse generator; this, of course, working at a low voltage. The recurrent surge generator is connected to the transformer, adjusting the characteristics of the circuit until the required wave form is obtained.

Rotating Plant

Other test equipment in the factory, installed in a bay alongside the high bay, provides for complete testing, including full-scale heat run of a 600 MVA transformer. The principal equipment consists of four 10 MVA alternators driven by d.c. motors (to give variable frequency) combined with 42 MVAR of capacitors. One of the alternators may be synchronised to the incoming 11 kV supply and used as a synchronous motor to drive its associated d.c. machine, so giving a variable d.c. supply for testing reactors. There are two 1 MVA machines used to give a variable frequency auxiliary system, and a third set rated at 7.5 MVA used in over-potential testing at frequencies at 1,000 and 2,000 c/s.

Test transformers in separate cells adjacent to the machine hall give voltages between 11 kV and 80 kV in

Table. 1. Foreseeable transformer requirements

Voltage ratio	Size	Line load current		Short Cct current LV	Weight
		HV	LV		
kV	MVA	A	A	kA	lb × 10 ³
150/33	150	575	2,630	17.5	225
300/20	600	1,160	17,300	102	490
400/20	800	1,160	23,100	136	620
500/20	1,000	1,160	28,900	170	750
500/300*	1,500	1,730	2,880	24	620
500/400*	1,500	1,730	2,160	21.6	420
400/300*	1,250	1,800	2,400	24	400
300/150*	500	960	1,920	16	350

* These transformers will be auto-transformers with a tertiary delta winding.

BRITISH TRANSFORMERS IN UNITED STATES

AMERICAN technical papers have widely reported, during the past year, trouble with breakdown on some large English Electric transformers. During our visit to the new English Electric Co. transformer works, a spokesman said that such breakdowns were largely connected with the use of the sealed gas-cushion arrangement, which for some time has been favoured by the American supply industry as a preferred alternative to conservators. English Electric had to comply with US specification requirements by designing for the use of this system, despite misgivings about it. Now research has shown that the gas-cushion technique results in evolution of gas bubbles which can form points of local voltage stress, favourable to electrical breakdown; and that it also encourages formation of water droplets. It has now become known that US-

manufactured transformers have also suffered breakdowns, presumably from this cause.

In the gas-cushion technique, a space is left above the oil surface sufficient to permit expansion of the oil. This space is filled with nitrogen from a "top-up" cylinder, the pressure being regulated. There is no air access; so oxidation of hot oil due to its contact with the air of the atmosphere (as can happen when a conservator is used) is avoided.

An important disadvantage of the gas-cushion method arises when it is worked with the nitrogen pressure allowed to vary over a range as large as 2 lb/sq in. to 8 lb/sq in. At the higher pressure, the oil absorbs a volume of nitrogen, which it is slow to give up as pressure falls: it becomes supersaturated with nitrogen. After a time delay, this nitrogen

is released as small bubbles, which are liable to give the stress concentrations already mentioned.

Another trouble occurs because, with the sealed gas space, there is, as oil warms up, a transfer of residual moisture from paper insulation to oil, and thence to the gas space. Concentration of moisture vapour there reduces the dew point. Because of this, when ambient temperature falls, water may condense on the tank roof and drip down on to the windings in concentrated droplet form. If such droplets get into the transformer winding, the risk of breakdown is much increased.

Every transformer the English Electric Co. have sold in the US has now been changed to conservator oil preservation with the customer's agreement, in some cases "enthusiastic agreement."

stages of about 1 kV. Connection to l.v. winding or tertiaries permit voltage testing of the largest transformers.

Testing carried out at shop floor level is marshalled from control galleries overlooking the test area. Radio link is used between the various members of the test team to facilitate speedy progress.

Design Trends

Papers presented at the symposium already mentioned fill in the design technique background to the impressive facilities provided by the new works. These must be viewed against predictions of trends in transformer design, the basic consideration of which is that cost per MVA of transformers falls significantly with increase in size, while the associated high voltage and low voltage switchgear, foundations and the necessary land does not change much for a doubling in transformer size.

There are, of course, a number of technical limitations to continued increase in size. There is a general view that individual components of electricity supply systems should not exceed 5% of the aggregate capacity and that the maximum size of a generating unit should not exceed the transmission capacity of the overhead lines. Switchgear design imposes a limit on short-circuit capacity and the current rating of both h.v. and l.v. windings may be limited by that of associated equipment. Overall, there is a limit of about 200 tons for world transport, imposed by bridges, dock cranes and vehicle capacity.

Currently, the increase in flux density is one of the most effective ways in reducing transformer weight. It is common practice now to use as much as 17 kilogauss density for generator transformers and between 15.5 and 16 kG for transmission transformers. Increase in current density can also help reduce weight, but the increased copper loss is uneconomic where load factors are high. The third approach to weight reduction is economy in the weight of structural steel used, which represents about 20% of the transport weight of large transformers. However, although this has led some European manufacturers to use wood liberally there are attendant disadvantages, notably shrinking and production of alkalis in the oil. Aluminium can reduce weight and size—with non-ferrous metals, tanks can fit more closely to windings—but stress requirements make the saving less than comparison of density suggests, there is inherent danger of arc damage,

eddy loss is increased. In the opinion of EE Co. designers, aluminium "is a last resort" as a contribution to weight reduction.

Combination of 18 kG flux density, high current density (4,000 amp/sq in.) and a lightweight tank could give a 50% reduction in weight, say less than 200 tons for a 450 MVA, 300 kV generator transformer; but the unit would be uneconomic.

English Electric are investigating as an alternative a subdivision of transformers, three possibilities being:

1. Use of three-phase groups of single-phase transformers.
2. Use of three-phase units with core building and winding assembly undertaken on site.
3. Use of subdivisible three-phase units.

Single-phase transformers cost about 20% more than three-phase units and have an iron loss 30% greater. Building on site is unlikely to be possible because of lack of really effective insulant drying equipment and of the testing plant now required. This makes manufacture of subdivisible three-phase units the best solution. A convenient design for subdivision has a five-limb core, which gives a yoke half the sectional area in that of a three-limb design. The proposed division would be between phases in a vertical plane, involving a break in yokes, tank and tapping leads, assuming three-phase on-load tap changing. So far, this idea has been carried to the developments tests on a one-third scale model and this has shown use of butt joints in such a unit to be free of major problems. The solution looks promising except that it does not solve loading gauge problems.

Windings and Insulation

From the electrical, as distinct from magnetic, aspect, paper, fullerboard and oil remain the major elements in transformer construction. Although paper is the basic material for conductor insulation, the development of larger transformers operating at higher voltages has pointed the need for a new insulating material which combines superior insulating properties with better space factor. A terylene material called Melinex is thought to be promising in this respect. It has a higher breakdown strength than oil-insulated paper (4,000 V/mil at 50°C) with an equal dielectric constant and it is impervious to moisture.

is the impervious nature of the Melinex that makes application difficult; for oil cannot penetrate it, so there is some risk of air voids and corona formation if it is applied solidly to a conductor. It is being used in combination with paper in a patented way. The conductors are insulated with paper tape, and then Melinex in U cross-section is applied alternately upright and upside-down on adjacent conductors. The open ends permit penetration of oil into the paper, but a good measure of inter-conductor insulation is provided.

EE Co. use solid fullerboard for transformers above 110 kV, the major advantage claimed being smaller radial stresses, only about half that for the conventional fullerboard barrier system. Solid fullerboard is also stronger mechanically. To give reinforcement where axial radial stresses interact along the surface of the fullerboard, each interleaved h.v. disc coil is individually impregnated with additional layers of paper, in a manner that permits access for oil.

Impulse strength considerations with h.v. windings point to the need for some form of interleaving. The technique used by the EE Co. is to have pairs of discs alternately winding conductors from the two coils concerned. Only a few interconnections are required, and the mechanical strength of the disc coil is obtained, together with increased capacitance that can improve impulse performance.

DESIGN

Increased flux density in transformer cores has already been mentioned. Other changes concern methods of joining together the core laminations. As an alternative to bolting with through bolts, use is being made of two techniques exploiting plastics materials. In one, a close-fitting tube of polyester resin glass tape is fitted over the joints and subsequently cured in position to hold the laminations. In the other, a direct epoxy resin bond is used between individual laminations.

Directional properties of cold-rolled 3% silicon steel, important in reducing iron losses, have a complicating effect at the corners of core stacks. Here, there is a risk of excessive concentration of losses due to flux passing in the direction of the rolling. It is possible to design



Fig. 4. In winding a high voltage disc spiral coil a large number of conductors in parallel are wound simultaneously

corner arrangements that will restrict this effect, but they have to be considered in terms of complexity of cutting.

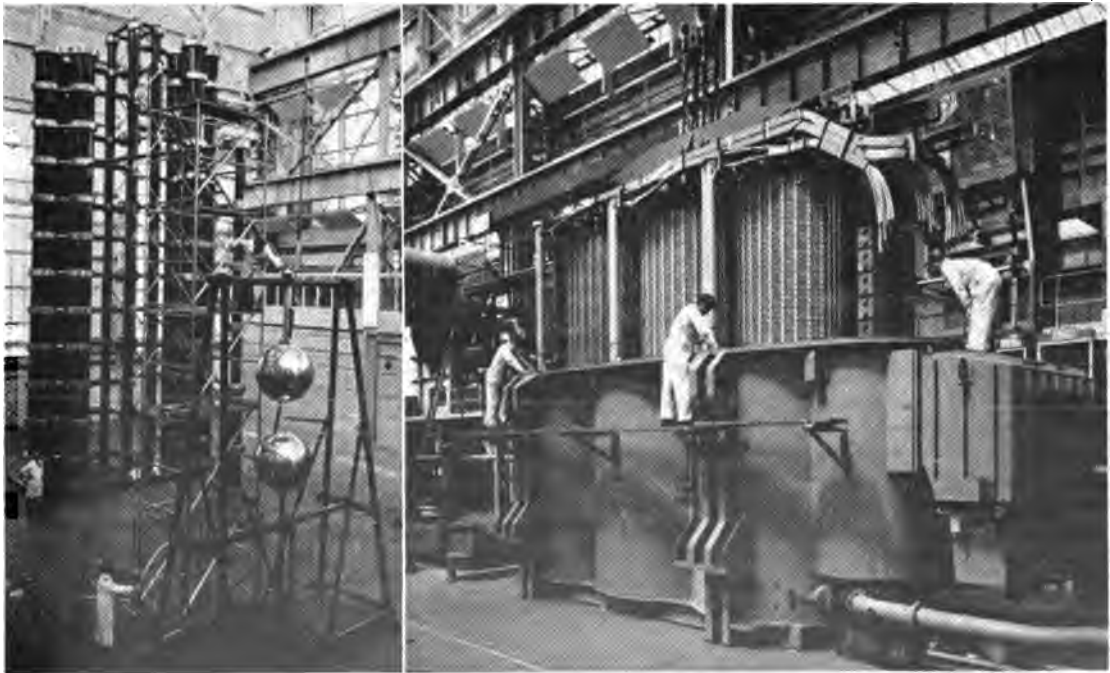
Noise

Increasing concern about noise is being evidenced by transformer manufacturers. Close attention to this problem is being given experimentally at Stafford. Amongst the techniques used is measurement of vibrations of cores to discover the fundamental origin of the noise. Of course, it is magnetostriction that causes the noise mainly, but quality in this respect varies widely over different consignments of cold-rolled steel that are nominally identical.

Theoretical investigation of the noise problem shows that the oil acts as an excellent coupler to transmit core vibrations to the transformer tank. If the noise transmission is not to be further increased, then the natural vibration frequency of the tank must be kept well removed from the significant components of core vibration. Tank stiffeners require careful consideration from this aspect.

right. The windings of a 16.2/295 kV transformer being lowered into its tank at new Stafford transformer works

left. Experiment associated with the 4.8 MV, 100 W-sec. impulse generator is being carried out before the transformer is completed. This generator has the highest peak voltage in Europe



Appliance approval in action

NOV. DEADLINE FOR FIRES, KETTLES, BLANKETS, CLEANERS

SUCH progress has been made with the plan for the approvals board for electrical domestic appliances that this week electrical manufacturers are to be approached to secure their full participation in respect of all their appliances falling within the first group selected for approval. Everything is set for a programmed change-over to full approval for all electrical appliances, although it is not certain when the time will be ripe for a publicity scheme to secure acceptance of the approval mark by the public.

It is less than a year ago that the provisional board of management was set up, and although the Board of Trade has not yet approved the Articles of Association, the organisation planned is a Council of representatives of the industry, the Home Office, National Chamber of Trade, EAW, BSI, and its advisory bodies, under the president, Lord Citrine, together with a board of management, under the chairmanship of Mr T. E. Daniel, with Mr C. A. Zweigbergh as full-time director.

Testing of appliances will normally be carried out at the EDA testing laboratories at Leatherhead, but if necessary other laboratories will be used such as the new BSI centre at Hemel Hempstead. All testing will be carried out to British Standards and the BSI have undertaken that all domestic appliances will be covered by appropriate specifications concerned with safety.

The main purpose of approval will be confined to protecting the consumer and it is felt that in the long run this will benefit all sections of the trade. The tests for approval will not only assess the electrical and mechanical safety features but also the reliability of such features. The testing will be performed on an initial sample or samples and from the resulting test report the committee responsible may authorise the manufacturer to use the approvals mark. However, reliance will not be placed on this initial test alone. It is planned to carry out check testing of approved models at suitable intervals but at not less than once a year. In addition, it is visualised that it may be necessary to visit the factory so that the organisation and conditions of quality control can be assessed as to their effect on the stable standard of production.

Final Approval in February

In the launching of this scheme two factors had to be kept in mind. There had obviously to be an interval of time between the setting up of approval facilities and the full impact of the scheme on the public, in order to ensure the flow of approved appliances through the trade. Also, it was necessary to prevent an excessive rate of application during the initial period so as to prevent testing facilities being swamped. For this reason, appliances have been arranged in groups convenient for laboratory loading. The first group chosen includes radiant fires, electric kettles, electric blankets and vacuum cleaners. Application forms, together with details of the regulations, are now available from the director of the British Electrical Approvals Board, 26-27 Cockspur Street, S.W.1. These

forms will be needed by overseas manufacturers importing domestic electrical appliances into the UK if they wish to secure approval by the new Board.

Timing of the first group programme has been fixed and application forms should be submitted not later than 30 November. It is stated that samples will be called forward as required and notification of approval given on 28 February, 1961. The initial work of approval will be eased by the arrangement of accepting, without further test, any appliance appearing in the current EDA list of approved appliances, and electric blankets that carry the BSI Kite mark will be automatically eligible.

The programme for the second group of appliances will not be finalised until after the initial applications of the first group have been received but it is expected that this will be arranged to overlap the first group; a timing early in the new year is, therefore, indicated. Experience will dictate the programming of other groups. The actual design of approval mark is expected to be agreed shortly and is one which must become the symbol of electrical safety.

GAS BOARD REPORT

FOR the second year running the gas industry records a deficit on the year's working, and most of the statistics in the annual report show a decline on the previous year. The bright spot was the 6.4% increase in gas sales to industrial consumers which reflects the increase in industrial activity and the growing use of gas as a fuel. Commercial sales were down 3.5% and domestic consumption by 7.2%; the number of domestic consumers fell and so did the production of coke. Under the stimulus of easier credit conditions, sales of appliances increased. The actual figures are shown in the accompanying table, compared with sales of electrical appliances by area boards, which of course is only part of the electrical sales story as it excludes electrical retailers.

Appliance sales by Gas and Electricity Boards

	Gas Sales 59/60	% Increase on last year	Electric Sales 59/60	% Increase on last year
Cookers ...	1795,578	+19.3	345,923	+21.1
Water Heaters ...	232,956	+17.8	259,005	+22.3
Wash Boilers ...	182,755	-20.8	65,398	-16.1
Washing Machines ...			161,998	+28.2
Refrigerators ...	88,350	+76.5	172,537	+109.2

Success is reported with new designs of low priced refrigerators and the use of thermostatic control instantaneous water heaters. A special cooker for physically handicapped people was introduced during the year. Novel methods of flueing water heaters, space heaters and drying cabinets have been introduced for multi-storey flats and the thirteen schemes in operation are fully instrumented for record purposes. Some 2,000 dwellings using such methods of heating are in course of erection.

I.E.E. local centres

CHAIRMEN'S ADDRESSES DEAL WITH TELEPHONY AND SUPPLY
DEVELOPMENT IN MANCHESTER AND NORTH SCOTLAND

Recent developments in telephone instruments and in the exchange and line equipment were outlined in the address to the East Midlands Centre of the IEE, given by Lt-Col W. E. Gill, T.D., M.I.E.E. (Lt-Col Gill is phone Manager of the GPO, Peterborough Area.)

Although the telephone instrument had changed considerably with the advent of a "new look" and use of new materials, notably printed circuits and gravity switches, the only major addition was an automatic regulator, the principal change in design was replacement of conventional magnetic diaphragm by the rocking armature receiver.

The automatic regulator, now incorporated in new instruments, superseded the barretter device previously used at exchanges which compensated for the considerable changes in line resistance experienced on calls over great distances. The variety of calls handled by modern instruments exceeded the range of the barretter device; it has been replaced by a regulator consisting of a variable loss network made up of rectifier elements and designed to prevent excessive loudness on short lines. The frequency range of the new instruments remained in the 1 300 to 3,400 c/s, which gave intelligible conversation at undue cost; however, the instruments achieved better response with consequent reduction in distortion. The rocking armature receiver was largely responsible for the great increase in sensitivity obtained.

Development of new subscriber requirements in unexplored areas could only be met in the past by providing excess of cable pairs. Lt-Col Gill outlined the "Cabinet-to-d.p. flexibility scheme" which has eased this particular problem considerably by permitting diversion of cable pairs between terminal points. In the cabinet, a cross-connecting frame has, on one side, terminations for main exchange cable pairs; and, on the other side, cables radiating to a number of pillars. Cross-connection in the cabinet permits selected exchange pairs to be put through to these pillars. Similar cross-connecting arrangements in the pillars permit any pair from the cabinet to be connected to cables linking to a number of d.p.s.

This system gives economy in the number of exchange cables—the most expensive item—and enables diversions to be made in the cabinets or pillars more quickly and simply than was possible in cable joints.

Cables and Trunk Dialling

Replacement of copper by aluminium conductors for telephone circuits was, he thought, unlikely, but plastics cable sheathing was rapidly gaining ground over lead as it was lighter, tougher and cheaper. Plastics cables could also be laid without the relatively expensive earthenware ducts which were necessary to protect the lead-sheathed cable. All local cables up to 100 pairs were now of the all-polythene type and the range would undoubtedly be extended. Their main disadvantage was jointing.

It seemed likely, said Lt-Col Gill, that the first electronic exchange would be installed in London within the next two years. Already, exhaustive tests had been carried out on the experimental exchange at Dollis Hill, which had access to the London network.

The modern telephone system, by using carrier current working and improved designs of amplifiers, had permitted great reductions in cable weight. The latest coaxial system under construction could cater for nearly 2,000 speech circuits using only two coaxial pairs of $\frac{1}{4}$ in. dia and with a three-mile spacing for repeaters.

Supply in the Manchester Area

Meeting the growing electricity requirements of nearly half a million consumers and creating a new single supply organisation from seven separate undertakings was how Mr F. Linley, M.I.E.E., A.M.C.T., chairman of the North West Centre, summarised the work of the past 12 years in the Manchester area when he concluded his address, "Achieving Our Purpose." (Mr Linley is manager of the NWEB Manchester sub-area.)

Outlining the history of the sub-area since 1948, Mr Linley described some of the problems which had to be overcome in the seven sub-areas, which include Greater Manchester. This sub-area, although having an area of only 120 sq miles, had a population of 1½ million and by far the greatest concentration of commerce and industry in the country.

Originally, to maintain the personal touch, districts were limited to about 60,000 consumers. Subsequent experience had shown that 80,000 consumers and their associated system could be handled satisfactorily as a district and this led to merging of two of the smaller districts.

The character of the different undertakings in 1948 gave rise to serious load-sharing difficulties and instability, since the network operated both as a transmission and distribution system.

For example, 340 MVA or 84% of the total load comprising Eccles, Sale, Stretford, Manchester and Cheadle undertakings was carried on a solidly connected, 33 kV system, fed by only three power stations of any size and with only a single grid connection at Barton.

Three steps taken by the sub-area to improve supplies were outlined by Mr Linley. In the first stage Carrington power station was commissioned, two further grid intake points were introduced and certain loads transferred.

Three further grid intakes, including one in the centre of the city, comprised the second step. During this stage, outdated switchgear at Barton was replaced and the 33 kV feeder protection system modernised.

Work continues on the third step, aimed at meeting a compound load growth of nearly 6% p.a., which has resulted in a rise from 400 MVA to over 700 MVA and which may well increase to 1,100 MVA by 1968.

In this stage, a further four grid intake points will be required and also 275 kV intakes at Carrington and Staly-bridge. Further load transfers will also be made.

A striking indication of improvement in reliability was quoted by Mr Linley for the Altrincham system, which originally operated at 2 kV. In 1948, 36,000 consumer-hours were lost by faults. This was reduced to 120 consumer-hours in the first eight months of this year, despite a load increase from 13 MVA to 30 MVA. This achievement was largely as a result of a £500,000 scheme for the 11 kV and lower voltage distribution systems.

Much of the ex-Manchester 6.6 kV system has been uprated to 11 kV and, although this decision has paid, it was accompanied by, as Mr Linley put it, a disturbing number of faults, mainly on cable terminating lengths and end boxes.

Load growth is expected to require construction of nearly 2,000 substations by 1968, representing a commissioning rate of one every three working days. Difficulties of obtaining suitable sites meant increasing use of transformer units in underground chambers or buried in footpaths.

Development of standard techniques for construction and operation work was given early consideration and it was decided not to wait for area board or national standards to be established. Although some changes have been necessary, this decision has proved justified. An example was safety regulations, which were drafted and in use in a few weeks. Safety requirements were found to conflict with the breaking capacity and operation of many existing switchgear installations and a programme for replacing this gear by units of 150 MVA and 250 MVA rating at a cost of nearly £200,000 is now two-thirds completed.

A vital decision, taken early, was to centralise control at the existing control room in Dickinson Street. This control room now has facilities for control and alarms in 4-132 kV substations, 34-33 kV substations and 117-11/6.6 kV substations and co-ordinates switching of 1,350 network stations.

An early introduction essential to the success of a centralised control scheme was standardisation of all diagrams and methods of operation. The control room now has a complete system diagram and shows all earthed equipment and plant abnormalities. Communication with local substations is maintained through 11 automatic exchanges and about 1,200 telephones. A radio transmitter has also been installed at Stretford, covering the whole sub-area, and 32 vehicles have two-way radio telephones.

Mr Linley concluded by examining the use made of the efforts. He said that only 7% of the total load was on for 100% of the day, whereas the final 25% was only on for about 3% of the day. Such inefficient use of the available resources, he thought, indicate the urgent need for fuel cells or energy storage to meet peak demands.

Supply in North of Scotland

Supply developments also formed the subject of the Scottish chairman's address, given this year by Mr R. B. Anderson, M.I.MECH.E., M.I.E.E. (Mr Anderson is Dundee district manager of the NSHEB.)

He traced the history of supply undertakings from the first plant established in 1890 to the present-day work

of the NSHEB. This first installation was built by the monks of Fort Augustus Abbey only eight years after the first experimental station was brought into service in London.

The NSHEB was established in 1943 under the chairmanship of Lord Airlie. Within 18 months, hydro-electric construction schemes were published amounting to nearly 137 MW, including the 130.5 MW Loch Sloy station. Before the Electricity Act was passed in 1947, the Board had ordered 488 MW of hydro-plant and two stations, at Morar and Lochalsh, had been commissioned.

As a result of the Act, the NSHEB took over 16 undertakings totalling 230 MW installed capacity. They became responsible for generation, transmission and distribution in a sparsely populated area in which about half the population of nearly 1.2 million were without supply, and several d.c. to a.c. conversion schemes were required. In the 16 years since their formation to 1959, total capital expenditure by the Board amounted to £205 million and the addition of nearly 196,000 new consumers had nearly doubled the number connected. Mr Anderson drew attention to the rise in cost of connection by comparing the 1948 figure of £100 with the 1958 figure of £270 per consumer.

Hydro generation investment amounted to over £141 million, spread over 38 schemes totalling 785 MW, and with an estimated annual output of 2,148 million units. Two-thirds of this total was consumed in the Board's area, and the remainder, sold in bulk, assisted in paying for supplies to rural areas.

Mr Anderson referred to the NSHEB practice of using a carrier system on power lines for protection, control and communication. Facilities exist on the entire 132 kV network. The carrier system was used for high-speed protection and remote control of unattended hydro-stations.

The Board had experimented with a gas turbine installation at Dundee, a peat-burning, open-cycle installation and a 100 kW wind generator, but none of these schemes seemed to be economically justifiable at present.

In conclusion, Mr Anderson referred to the 400 MW pumped storage scheme now under construction at Loch Awe. This scheme is anticipated to give a cost per kW of only £38 and the annual charges per kW are expected to be considerably lower than other types of generating plant.

Nearly 90% of all possible consumers are supplied and present schemes aim at supplying a further 5,000.



Fig. 1. Manchester control room at Dickinson Street. The centre has a wall diagram of the complete system and has facilities for control and alarms at 155 substations and 1,350 network switching stations

NOTES ON WIRING

BY M E G O H M

NOW that the time has arrived for us to seek the company of the fire in the evenings, some of us will be looking more closely at the decorations in home, and either congratulating ourselves on having them or visualising the task ahead of us. Whichever gory one falls into I feel sure that at some time he, he, must have looked at the switch and socket positions vowed that something would have to be done about business of "feeling" for a switch in the darkness, and subsequent grubby evidence. I was in such a mood the other day, and my aching limbs kept reminding of the fact that unless something was done then my effort might be spoiled.

still had the problem on my mind when the answer placed in front of me. The answer was in the shape perspex "collar" of the size to fit around and behind cover plate of a flush switch of the type mounted in 1299 or 1363 boxes. It is called a luminous locator and, in my opinion, is an excellent way of finding a switch in the house, for it emits, in the darkness, a bright green phosphorescent glow all round the accessory. In daylight it has an ivory colour and extremely pleasant to look at. The connecting leads are fitted to the "luminator" and the switches are incorporated in the unit.

I am privileged by being one of the few people to have one of these installed in my house, and it has aroused great interest and admiration amongst friends. I have sited it on my porch, where previously people did have difficulty in finding the switch.

Of course, the house is not the only place where I can use this most useful accessory being used. I recently mentioned the homes for elderly and infirm people and I see great use being made of it in such places. The 5s 8d is surely as reasonable a one as anyone can ask for. Some accidents in the home could be prevented by this accessory.

Cartridge Fuses

Many homes are now equipped with consumer units which use cartridge fuses. My own house is, and on doing a normal check of spare fuses, etc., before the winter sets in I discovered that there were no 30 A ratings in my stock. Next morning I walked into my local electricity showroom and requested: "Two 30 A cartridge fuses," and was rather surprised to learn that, besides not having them, the gentleman serving me did not know where they were used in the normal household. I explained I had two such fuses in my consumer unit at the present position but it still failed to register. I explained you could either have rewirable or cartridge fuses in such a unit, and I left the shop almost feeling that it must be me that was wrong after all.

I then made my way along to two electrical shops and got the same answer but with a slight difference. Both shopkeepers informed me that they only stocked a few cartridge type fuses of the lower rating as they found that most householders regarded the local electricity showrooms as the "correct" place to purchase such things. I must say that the two shopkeepers knew what a 30 A cartridge fuse was and why I wanted one. It seems to be

a sad state of affairs when this happens. No wonder there is the resort to such things as tinfoil and pieces of hairpin that we hear about to keep apparatus going!

Indicator Lights

I had an interesting chat with a resident engineer the other day on the matter of indicating lights and was pleasantly surprised to be shown some of his ideas on the matter. Perhaps he had carried his ideas a little too far, for he had near indicators on all his main switches and all his isolators, etc. On his t. p. and n. switches he had three indicators with different coloured glasses. I admit that the installation was very old and that he had had a lot of trouble with fuses and so on due to badly trained operators on the machines. This was his way of trying to do something about it all and, at the very least, it helped him to find the spot affected quite quickly.

I wonder just how many plants are in a similar bad condition through bad maintenance and lack of money being diverted to the engineering works? Machines are in some people's minds something which *should* work for years and years without trouble. Similarly, electrical installations are thought to be ageless. I have often expressed my opinions on the possibilities of providing a reasonable inspection and test of installations, but I cannot see any move in the industry to provide such facilities.

Site Conditions

My recent remarks on alleged conditions prevailing on building sites, when little or no care was given to the electrical conduits, etc., by the builder, have attracted evidence suggesting that these are not so isolated as I had hoped. Letters from my readers comment not only on the attitude towards the electrical installation but to many other things. One contractor told me this week that he had laid m.i.c.c. cable in a floor screed having first ascertained that cork tiles were to be stuck down on the finished floor. The work was done with the full approval of the architect and my friend was startled to learn a few days later that faults had developed in the wiring system. Investigation showed that although the cork tiles had been stuck down they had also been "pinned" at certain places by means of nails similar to the old-fashioned gramophone needles. The m.i.c.c. cables were pierced in places by these needles.

Much of this sort of trouble appears to be the result of "sub-contracting" certain works by the builder. Many builders, of the smaller size especially, employ only labourers and perhaps one carpenter and one bricklayer. When such a builder gets a job to quote for, he obtains other quotes for the plastering and plumbing, etc., and it is quite obvious that these sub-contractors do not wish to waste any time on the job or be held up by, for instance, the electrician altering a conduit or something of that nature. Plasterers are well known for such attitudes for I have seen many instances of boxes being 2 in. behind the face of the wall and elsewhere on the same wall a box protruding ½ in. beyond the finished wall. These are the things which get the building industry a bad name and we in the electrical trade cannot afford to share it.

OVERSEAS NEWS



from our correspondents abroad

CANADA

Another Station

The Red Rock Falls generating station of the Hydro-Electric Power Commission of Ontario entered its final phase recently when the last diversion portgate was closed and the river started backing up behind the dam. Expected to be in operation late next month, the 38 MW development on the Missisagi River is, in fact, the smallest of the 13 hydro-electric plants built by the Commission since the war.

Direct Sales Hit Retailers

Direct sales of electrical appliances by manufacturers to apartment builders and developers, coupled with a general falling off in the appliance market is causing concern to Canadian retailers. The practice of manufacturers supplying builders direct originated 25 years ago but has only been adopted by Canadian manufacturers in the last two years to encourage sales. Retailers complain that apartment builders are obtaining refrigerators and other domestic appliances sometimes at less than the wholesale price to the retailer, and that some of these are "leaking" to the general public. Mr Jack Blustein, of New Era Home Appliances says that if the situation does not improve many retailers will be put out of business. Mr S. J. Randall, president and managing director of General Steel Wares, who make washing machines and other domestic electrical equipment, is reported to have conceded that his company offer special rates to builders. But in a period of shrinking sales, manufacturers can't expect to stay in business when other manufacturers, many of them subsidiaries of US companies where the practice is widespread, offer builders reduced rates. Mr Blustein argues that if the manufacturer sells his products at cost or less than cost to apartment builders, he must increase his price to the regular retailer and, therefore, the ordinary citizen is actually subsidising apartment builders.

Columbia Power Controversy

Formation of an international power pool to make full use of Canadian hydro-electric potential was urged by Mr J. D. Stevens, consultant for the Peace River scheme, and Mr R. D. Chantrill, AEI Ltd. They were speaking at the forty-fourth annual conference of the Pacific North-West Trade Association.

Criticism of the proposed 50-50 basis for sharing downstream benefits of the Columbia River scheme, between Canada and the US, were made by Dr John Davis, director of research and planning for the BC Electric. He maintained that the combination of Canada supplying more than ten times the capital provided by the US, and the higher rates of interest prevailing in Canada could well mean that Canadians would pay up to 20 times more than Americans for their electricity. He also urged the proposed order of construction should be changed, that the Arrow Lake and Mica Creek schemes should be combined and that these should be followed by Libby dam.

Nuclear Association Formed

A central agency to stimulate development of nuclear energy for peaceful purposes, the Canadian Nuclear Association, has recently been formed to correlate the requirements of industry, utilities and educational institutions in nuclear development.

President of the association is Ian F. McRae, chairman of the Canadian General Electric Co., and the vice-president is the Ontario Energy Resources Minister, Mr R. W. Macaulay. Objectives of the CNA are to promote healthy growth and use of nuclear energy and radio isotopes and to encourage co-operation between all authoritative bodies by providing a forum for discussion of problems concerning members of the industry or public.

The association will study technical problems, professional and technical manpower requirements, legislation and insurance problems and education, and will produce publications on home and overseas developments and opportunities.

WEST INDIES

Assisted Wiring

An assisted wiring scheme is being introduced by the Trinidad and Tobago Electricity Commission under a Bill passed by the Legislative Council at its last session. This empowers the Commission to wire homes and recover the cost over three to five years. The scheme is intended primarily to bring electricity to owners of smaller property. Consultations have been held between the Electrical Retailers' Association and wiring contractors to produce schemes whereby groups of houses, of about 60 or more, can be wired as one project, thereby reducing the cost. As a start,

it is proposed to undertake four trial projects, two in North and two in South Trinidad.

U.S.S.R.

Exploiting Solar Energy

Developments in the use of solar energy were discussed at a recent conference held in Tashkent, the capital of Uzbekistan, a Soviet republic containing two of Central Asia's biggest deserts. A solar thermal station has been developed with a capacity of 2.5 MW, able to irrigate up to 12,500 acres and to distil drinking water for the entire population of an oasis. The conference discussed methods devised by Soviet technicians for establishing "solar oases" in the desert, utilising the power of the sun.

SCANDINAVIA

Budget Benefits Industry

The Norwegian budget for 1961, recently presented to Parliament by Finance Minister Petter Jakob Bjerre, provided for various telecommunication and hydro-electric schemes. £2.5 million has been allocated for hydro-electric schemes which will absorb a total capital investment of £13 million, of which the Tokke scheme will absorb nearly £6 million. It is proposed to spend nearly £3 million on road construction and nearly £2.5 million on telecommunications. Estimated deficit for the State Railways will go down by £2.5 million. Increased grants for the railways are likely to be proposed as a step in their modernisation programme.

Power Exports

A 380 kV power line between Helsingborg and Hamburg is the main alternative in the current investigations into the possibilities of co-operation in the field of power supply between the Scandinavian countries and Western Germany, according to the Swedish State Power Board. A study committee with five expert groups has been appointed and is expected to present its findings early next year. Norwegian member of this committee is Dr F. Vogt who was until recently director-general of the Water courses and Electricity Board.

NIGERIA

Electrification Progress

A further stage in the programme electrical development in Western Nigeria provides for supplies to eight

further towns by the end of this year. The five-year electrification plan, which is based on a £1.3 million interest-free loan by the Western Region Government, provides for electrification of 32 towns by the end of 1961.

INDIA

Nuclear Tenders

The Government of India is now seeking global tenders for the nuclear power station which is to be located near Tarapur, about 62 miles north of Bombay. As we reported on 1 Sept., the station is to have two reactors, each of 150 MW. There is likely to be keen competition for this first nuclear power plant for India.

PAKISTAN

Multan Power Station Extension

Multan natural gas power station is to be extended by 130 MW. A letter of intent was recently issued by WAPDA to four West German firms for the supply and installation of the equipment for which 85% of the foreign exchange cost will be met by a loan from West German banks. The extensions will comprise two, 65 MW turbo-alternators with natural gas-fired boilers and they are to be completed within 35 months.

Bank Loan to WAPDA

A loan by three leading Pakistani banks to WAPDA of Rs5 crore will assist WAPDA to finance power projects which include the Quetta thermal station and Rawal hydro-electric project. WAPDA is issuing debentures worth Rs5 crore to cover these schemes and a further Rs11 crore will be utilised for extending the Multan natural gas power station.

Expanding Production

If a recently announced plan is fully implemented, production of the electrical goods in Pakistan is likely to increase by 150% in the next five years. The plan expects that more than Rs6 crore will be spent on the improvement and expansion of the electrical goods industries. At present, Pakistan imports Rs2 crore 7 lakh worth of electrical goods every year and, out of this total, Rs2 crore are spent on importing appliances and new goods and Rs70 lakhs on spare parts.

Progress on construction of Italy's Latina nuclear power station is indicated in our accompanying photograph, where the six heat exchangers are now seen in position. The design for these vessels was supplied by Head, Wrightson and Co. Ltd., and they were manufactured in Italy by Nuovo Pignone. The Latina power station is being built by the Nuclear Power Group

AUSTRALIA

Supply Change Reduces Cost

From 1 Sept. electricity supply in Collinsville and Scottville is the responsibility of Townsville, Queensland, Regional Electricity Board. The Regional Board has taken over the existing undertaking operated by the Shire of Bowen. Substantial reductions in the electricity charges are made possible by the change.

Line Extension

A power extension scheme, estimated to cost £375,000, is proposed by the North West County Council. The extension, covering some 375 miles, will serve rural areas of New South Wales and Southern Queensland, including the towns of Boomi, Talwood and Bungunya. If prospective consumers approve, work is expected to begin next month and the whole northern border extension should be completed by the end of 1963.

Aluminium Plant Deal

The Commonwealth Government decision to sell its share in the Bell Bay aluminium plant to Consolidated Zinc for £11 million was recently announced by the Premier, Mr Reece. Under the agreement, which was the result of two years' protracted negotiation, the Tasmanian Government will retain a one-third interest in the plant. Future of the plant is not only ensured but expansion is planned from the present output of 12,000 tons of aluminium to 28,000 tons and later to 40,000 or 50,000 tons.

The existing plant takes 35 MW from the State Hydro-Electric Commission and increased power for the expansion

programme will be met under the Commission's development programme which was drafted several years ago. Supply to the plant will be augmented by power from the Poatina scheme when it comes into operation in 1964.

Tully Hydro Scheme Progress

A further stage in the Tully hydro-electric scheme for bringing power to North Queensland was completed recently when the Premier, Mr Nicklin, inaugurated the Koombooloomba Dam. Three regions served by the Cairns, Townsville and Mackay Regional Electricity Boards will benefit from the project which is estimated to have cost them so far £40.5 million. Work on the dam began in August, 1956, and, owing to urgent power demands, the completion date was advanced from 1962 to 1960.

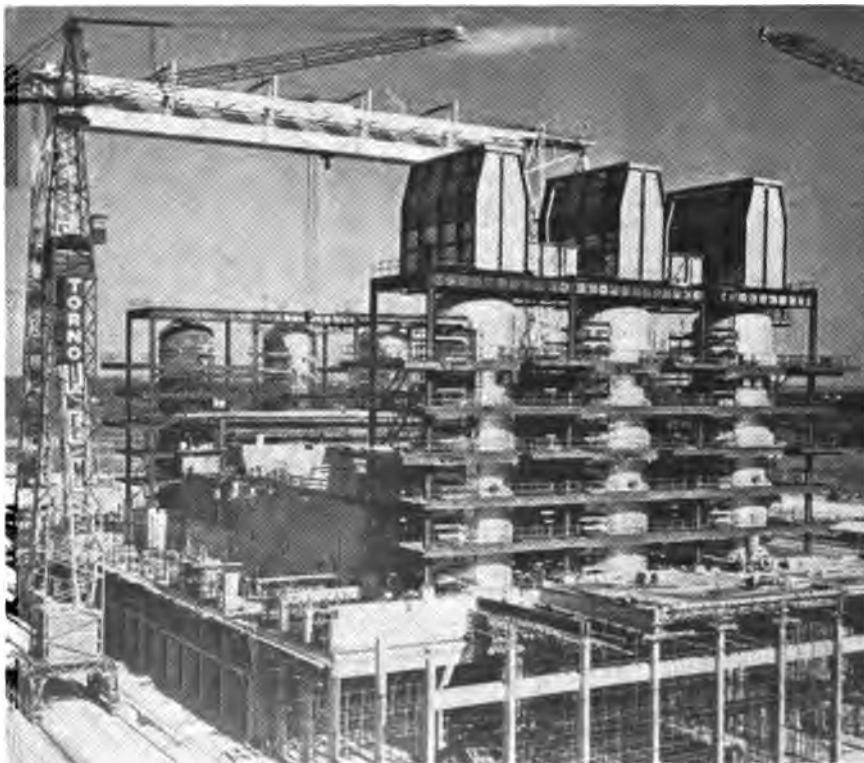
Debenture Stock Conversion

The Electricity Trust of Southern Australia is to offer early conversion of publicly held £5,558,870 of 4½% debenture stocks. These debentures, which mature on 1 June, 1962, can now be converted to new debentures with an eight-year term.

THAILAND

H.E. Experts

Recently a group of Australian scientists and technicians left Australia to begin development work on the Mekong River scheme. This scheme will provide power for Thailand, Laos, Cambodia and Vietnam. In addition to providing hydro-electric power, the scheme plans for irrigation and flood control of South-East Asian countries with a population of 17 million.



Personalities *in the industry*

Newly elected president of the Purchasing Officers' Association for 1960-61 is **Mr W. H. Parry**, who joined the Charles Colston group two years ago as purchasing manager. He was later appointed commercial manager and vice-chairman of the group Purchasing Committee. This year he became general manager of the High Wycombe Division. Before joining Colston Mr Parry was chief purchasing agent of Simplex Electric Ltd.

Atlas Lighting Ltd. announce the appointment of **Mr R. A. Barrington** as area manager for the London North sales area, operating from 105 Judd St, W.C.1. He joined Thorn's in 1950 as sales representative for the Central London postal district.

Mr C. H. Sparks, formerly a director of Babcock and Wilcox, has been appointed in an advisory capacity to the board of Hawker Siddeley Brush Turbines.

Mr W. L. Henderson has been promoted to manager of the London works of Dowding and Mills Ltd., with **Mr P. A. Chambers** as assistant. At the firm's Birmingham works **Mr H. Westwood** becomes manager, with **Mr F. J. Gardiner** as assistant.

Mr J. G. Christopher, director and general sales manager of Atlas Lighting Ltd., left England last week-end on a visit to South Africa. His itinerary includes calls at Johannesburg, Cape Town, Port Elizabeth and Durban and, before returning to England on 8 Nov., he will visit Thorn's associate company, Ilesia, in Vicenza, Italy.

The Leon Gaster Memorial Premium of the Illuminating Engineering Society for 1960 has been awarded to **Mr H. C. Weston**, O.B.E., F.I.E.S., for his paper "Rationally Recommended Illumination Levels," which was presented at the IES summer meeting at Harrogate in May. Mr Weston was until recently with the Medical Research Council. He was responsible for much of the fundamental work carried out in this country on the basis for recommended illumination levels which has been incorporated in successive editions of the IES code. Mr Weston is now a consultant to Atlas Lighting Ltd.

Formerly area manager in the London district of Charles Colston's Electrical Appliance Division, **Mr K. R. T. Brown** has been promoted to district manager. The company also announce three appointments in the Midland branch: **Mr H. Griffiths** moves from South Wales to become manager of the East Midland district; **Mr C. J. Wilkins** becomes district dealer liaison manager in the south western district; and **Mr R. Rowntree** takes up a similar post in the South

Wales district. In addition, **Mr M. Lindsay** has been appointed an area manager in the South Scottish district, and **Mr W. Wilson**, district dealer liaison manager of the North Scottish district.

Mr T. H. Thorncroft, M.A., a director of the Harland Engineering Co. Ltd., has been elected to succeed the late Mr H. Cowan-Douglas as chairman of the company. Mr Thorncroft, who is also executive director of Wm. Baird and Co. Ltd., Glasgow, was deputy chairman of the Scottish Division of the National Coal Board from 1947 to 1949.

British United Traction Ltd. announce that **Mr Ronald Ellis**, B.SC.TECH.(HONS.), A.M.I.MECH.E., M.I.L.O.C.E., ASSOC.INST.T., relinquished his executive duties as general manager of the company on 15 Oct. Mr Ellis will, however, be appointed to the board of directors in order that his advice and guidance in the field of rail traction and trolley-buses will be continuously available to the firm. **Mr F. G. Headen**, the present secretary of the company, will take over Mr Ellis's executive duties as manager. **Mr J. D. Slater**, A.C.A., has also been nominated to the B.U.T. board of directors.

Mr W. T. Flower has been appointed deputy managing director of Bailey Meters and Controls Ltd., a subsidiary of Babcock and Wilcox Ltd.

General sales manager with Clarke, Chapman and Co. Ltd. for several years, **Mr W. Hanlon** has been elected to the board of directors. He joined the firm over 30 years ago.

Deputy station superintendent at Ipswich generating station, **Mr C. W. Tricker** was last week the recipient of a presentation from **Mr W. N. C. Clinch**, controller, Eastern Division, CEBG, on his completion of 50 years' service in the industry.

Mr Harry Copping, M.I.E.E., M.A.I.E., M.E.I.C., P.ENG., president and managing director of ECC Canada Ltd., has arrived in England on a visit to the parent companies: Electric Construction Co. and

George Ellison Ltd. He will also visit Tufnol Ltd.

Mr G. Orloff, M.I.MECH.E., A.F.R.A.E.S., has joined the Industrial Division of the Sperry Gyroscope Co. Ltd. as a consultant.

London Transport announces that **Mr J. I. McGillivray**, B.SC., A.R.I.C.S., A.A.I., has been appointed estate agent and rating surveyor, becoming an officer of the executive, with effect from 3 Oct. He succeeds **Mr T. C. West**, who has retired.

Crompton Parkinson Ltd. announce the following appointments to the boards of its subsidiary manufacturing companies. **Mr A. S. Duncan**, B.SC., general manager of the Newport works, has been elected to the board of the Young Accumulator Co. Ltd.; **Mr A. E. Gregg**, general manager of the Chelmsford works, has been appointed to the board of Crompton Parkinson (Chelmsford) Ltd.; and **Messrs J. C. Mansfield**, B.A., and **D. Ebben** who are assistant general managers, respectively for motor production and lamp production at the Guiseley works, having joined the board of F. and A. Parkinson Ltd. In addition, **Mr K. Younger**, general sales manager of the Crompton Parkinson Ltd. Heavy Plant and Transmission Division, has been appointed to the boards of Crompton Parkinson (Chelmsford) Ltd., British Electric Transformer Co. Ltd., and Cooke and Ferguson Ltd. **Mr C. J. W. Scott**, general sales manager of Crompton Parkinson Ltd., Industrial Motors and Lighting Division, has been appointed to the boards of F. and A. Parkinson Ltd. and Crompton Parkinson (Doncaster) Ltd.

Mr S. F. Newey, B.SC.(ENG.), A.M.I.MECH.E., A.M.I.E.E., has been appointed project engineer of the Midlands Project Group of the CEBG. (*ESH, page 52.) Since 1959 he has been an assistant project engineer with that Group. After serving an apprenticeship with the Brush Electrical Engineering Co., of Loughborough, Mr Newey graduated at Birmingham University.



Mr W. H. Parry



Mr A. E. Gregg



Mr K. Younger

ing which he joined the City of Birmingham Electric Supply Department. In 1950 he became general assistant manager in the Generation Construction Department of Midlands Division of the BEA. From 1952 to 1955 Mr Newey an assistant engineer with the City's East Midlands Division, followed by a short period as personal agent (technical) to the East Midlands Regional Controller. He then returned to construction work in the Midlands Division, becoming senior mechanical engineer at Wolverhampton in 1957.

M. W. Searle, managing director Extra (Birmingham 1935) Ltd., was duly presented with a silver rose in celebration of his 25 years with the firm. The rose bowl was subscribed by the managers and staff of Birmingham, London, Leeds, Eastbourne and Newcastle branches and was presented by Mr A. J. Tanner, general manager, on their behalf.

H. V. Rowlands has been appointed director for Burtonwood Engineers Ltd. He joined the company in 1954 and became a member of the board of directors five years ago. In 1954 he was responsible for forming the Plastics Division.

J. H. P. de Villiers, A.H.-W.C., B.Sc., has demitted office after seven years as hon. secretary to the Scottish Branch of the IEE. Mr de Villiers, who had been on the Centre Committee first as assistant secretary, is succeeded by **D. R. Rollo**, B.Sc., A.M.I.E.E.

G. F. Roberts has retired from the position of managing director of the Birmingham Electric Co. Ltd., and **Mr W. Enfield**, technical director, has also retired from the executive. Both are invited to retain their seats on the Board. The vacancies are being filled by the appointment of **Mr L. W. Laurence** and **Mr J. A. Shorter**, as joint managing directors, and of **Mr L. E. Ward** as technical director.

As general manager of the AEI Division, **Mr J. S. A. Bunting**, has been elected as a companion of the IEE. A member of the Council of the Electrical Research Association for many years, Mr Bunting has been chairman of the MCMA, the RCMA and the IMA itself. At present he is vice-president of the Export Association of the electrical industry.

H. G. Campbell, managing director Benjamin Electric Ltd., at a dinner at the Grand Hotel, Birmingham, last night presented an engraved gold wristwatch to **Mr D. J. Caddick**, the company's sales engineer for Birmingham district, as the award of merit for engineers of the company for 60 years.

As chairman of the Federal Power Board of Rhodesia and Nyasaland, **Sir Alan L. Robertson**, K.B.E., T.D., is to retire in June, 1961, on his 60th birthday. Sir Duncan, who practised as a

civil engineer on railway, road, bridge and tunnel construction from 1922 to 1939, has been responsible for the building of the Kariba hydro-electric project. He became chairman of the former Federal Hydro-electric Board in 1955 and of the Federal Power Board when it was formed in the following year. He was knighted in the last New Year's Honours List. **Mr G. R. Peterson**, B.A., M.I.E.E., M.I.MECH.E., was recently appointed general manager of the Federal Power Board to take over as chief executive from Sir Duncan. He had been deputy chief executive from 1957.

Mr W. A. G. Bass, B.Sc., A.K.C., M.I.E.E., has resigned from the board of Ferranti.

Mr R. L. C. Todd, of Thorn Electrical Industries Ltd., will leave on 23 Oct. on a two-month business tour of the Far East. He will be calling at Karachi, Lahore, Dacca, Chittagong, Calcutta, Rangoon, Bangkok, Hong Kong, Singapore, Sandakan, Brunei, Kuala Lumpur, Colombo, Bombay, returning via the Middle East.

Formerly representative for Berry's Electric Ltd. in London and the South East, **Mr L. E. Gates** has been appointed sales manager of the firm's Water Heater Division.

Mr F. W. Perks, sales director of British Radio Corporation Ltd. is to retire, and will be succeeded by **Mr T. B. Henderson**, general sales manager of Philco (Gt. Britain) Ltd.

OBITUARY

Mr David Yuille, of Robert Yuille and Sons Ltd., Glasgow, died on 11 Oct.

Mr R. S. Whitfield, who was control engineer at Darlington power station until retiring through ill-health in 1950, has died aged 62.

Mr Eustace Thomas, M.I.E.E., who was a partner in the firm of Bertram Thomas (Engineers) Ltd., died on 11 Oct., aged 91. In 1900 he joined his brother, who had recently started that firm, but earlier was with the BTH Co. and concerned in the early electric tramway developments.

Mr C. K. Woodbridge, chairman of the Dictaphone Co. Ltd., died on 16 Oct., aged 79.

Mr W. J. M'c. Girvan, O.B.E., A.M.I.E.E., formerly city electrical engineer of Belfast, died on 16 Oct. He retired in 1952 after holding that post for ten years. He originally joined that undertaking in 1913, and subsequently filled every technical and administrative position, becoming deputy city electrical engineer in 1935. He was one of three members of the Northern Ireland Joint Electricity Committee and chairman of the N. Ireland JIC and Joint Board for the Electricity Supply Industry.

The Earl of Verulam, COMP. I.E.E., HON. M.I.H.V.E., F.B.I.M., J.P., who died on 13 Oct., aged 50, was due

to take office as president of the Association of Supervising Electrical Engineers this month. His passing will be regretted in our industry, in which he had many friends. Lord Verulam was



Lord Verulam

chairman of Enfield Rolling Mills Ltd., Engineering and Lighting Equipment Co. Ltd. and Sternol Ltd. Educated at Eton and Christ Church, Oxford, he was employed in Austrian and German metal concerns from 1932 to 1936 when he formed Enfield Zinc Products Ltd. at Tottenham. He was managing director of Enfield Cables Ltd. from 1943 to 1953, and was Mayor of St. Albans in 1956-57. He was also for some years a part-time member of the North Thames Gas Board, and had been chairman of the British Institute of Management and the Institute of Industrial Administration.

BRITISH STANDARDS

Concrete Poles for Electrical Transmission and Traction Systems. BS 607: 1960. Price 4s 6d. This is a complementary specification to BS 1308, "Concrete Street Lighting Columns," for those applications where the torsional and bending loads are significant. Transmission line and overhead traction line supports are the obvious and intentional uses of the specification, but other uses involving similar stresses are also applicable. Originally published in 1935, this is the third revision, the main difference lying in the deletion of the appendix on recommendations for use of the three classes, reinforced, prestressed and prestressed with liability to impact, as transmission line supports, since it has been felt that conditions vary to such an

extent, as to make general recommendations a danger in practice. There are some other minor amendments.

Lamp Caps and Lampholders for Double Capped Lamps. BS 495: 1960. Price 3s. The original specification for caps in connection with double-capped tubular filament lamps was first prepared in 1932 and was last revised eight years ago. In this, the third revision, the title has been amended, the contents brought into line with current practice and a paragraph on the requirements for a combined pair of lampholders added.

Copies of these two standards may be obtained from the British Standards Institution, Sales Branch, 2 Park St, London W.1.

Denotes revision to the "Electricity Handbook, 1960."

New Zealand Plans Ahead

NEW ZEALAND supply authorities are likely to spend £5 million on capital account in the current financial year, £1½ million coming out of revenue. Expenditure is likely to continue at about the same level for the succeeding four years, say the official NZ Committee to Review Power Requirements, which reported recently. The Committee, who make an annual review of the forward situation, estimate that by 1965 the North Island will be experiencing a peak load of 1,307 MW, with an annual generation of 6,640 million kWh. Corresponding South Island figures are 562 MW and 2,710 million kWh. In 1970, the corresponding figures are: North Island, 1,780 MW, 9,038 million kWh; South Island, 763 MW, 3,677 million kWh. The Committee warn that the past experience of restrictions on use of electricity have brought a lack of confidence in the North Island, which is affecting the willingness of the public to use electrical techniques. However, the Committee believe that in three years' time the normal pattern of growth will be restored.

Another committee, the Planning Committee of Electric Power Development in New Zealand, has also produced their annual report. This Committee is concerned with the balance between power needs and plans for generating plant installation. At present, plans for the

North Island envisage some shortage in energy (as distinct from power) if any year after 1963 is dry in the hydraulic sense. There is also prospect of some shortage in the South Island in 1963 and 1964 in the same circumstances.

Submarine Cable

Some progress is reported concerning the proposed inter-island submarine cable link. Trial lengths of cable which had been laid off the North Island shore for about two years have been recovered and show no signs of damage, although they were placed deliberately in a rocky area. The cables are now being examined in England. The operation of lifting the cables was carried out in a small vessel and some doubts about problems of navigation during cable operation in these waters were removed. Evidence is increasing that the so-called short route is practicable for cable laying between the two islands. The report says: "If the reports on the trial cable and the tidal tests now being conducted prove favourable, the inter-island transmission based on the short route must be considered as one of the means of dealing with future power supplies." There is a warning that decisions about the use of the power at Benmore hydro station must be taken just as soon as essential issues are clarified.

KARIBA IN OPERATION

KARIBA generators have produced and dispatched 378.4m kWh during the first six months of operation at a generating cost of 0.4727d per unit and have contributed £Rh300,000 towards the financing of the second stage. That is the immensely heartening substance of the annual report of the Federal Power Board which was simultaneously presented in London by the chairman, Sir Duncan Anderson, K.C.B., T.D., and in Salisbury, Southern Rhodesia, by Sir Malcolm Barrow, C.B.E., M.P., Minister of Power in the Federal Government, on Monday last, 17 October.

This output corresponds to a saving of 190,000 tons of coal in thermal power stations and compares with the forecast of 0.869d per unit which it was anticipated would be reached in 1961. The Kariba project has, therefore, not only beaten the target date for commencement of supply—estimated as being 1961 in the 1956 estimates—but has also enabled the Board to show lower production costs than had been anticipated. True, the lower figure is to some extent accounted for by differences in the methods of calculation, in that the estimated figures were based on depreciation allowances which are not now considered necessary, but the net profit, with only two generators in operation, of £Rh350,520 enables the sum of £Rh300,000 to be transferred to the capital reserve account for the initial work on the second stage. The figures, of course, are based on the total profits from Kariba and the thermal power stations. The actual figure per unit for the mixed hydro and thermal supplies is 0.5796d, as compared with the original estimate of 0.757d per unit. As the Board has been able to sell the power at an average price of 0.7579d per unit during 1960, practically identical with the original estimate of cost, and has made an average monthly profit of more than £Rh50,000, the future for Kariba looks extremely promising indeed.

Consumption in the areas served by the Board has increased and, in the year ended 30 June, 1960, was 2.16% above the estimates. Revenue from sales of current totals

£Rh1.49 million, from which must be deducted £Rh410,000 for power purchased from the thermal undertakings. Load growth has been more rapid than expected at Salisbury and two further transformers have been ordered as extensions to the plant there in anticipation. One transformer for Bulawayo has been cancelled, however, as the demand here is not increasing as rapidly as expected.

Construction Costs

The report discloses some interesting features of the capital expenditure on the construction of the project. Originally estimated to cost £Rh79.414 million, the revised estimate, including additions to cover damage by floods, in 1960 was actually lower at £Rh74.755 million. This figure includes contingency allowances. Most of this saving is due to electrical and mechanical works which are down by £Rh6.7 million. The effect of this will be a reduction in finance charges which will also feel the effect of the early earning capacity of the scheme on the reserve fund. But Stage 1 is still not complete—No. 3 Generator is due for commissioning in the next few weeks and the fourth and fifth next year—and experience has shown what can happen at Kariba.

The Board is optimistic about the future and is already well ahead with its plans for Stage 2. Although no programme of construction has been prepared or finance sought, it is anticipated that work will begin in 1962 with a target date for completion in 1967. Other hydro-electric schemes at Kafue and Nkula Falls are also being studied.

Lecture at the I.E.E.

On Tuesday, 18 October, Sir Duncan Anderson joined with Mr T. A. Lyall Paton, C.M.G., B.Sc., M.I.C.E. (Sir Alex. Gibb and Ptrs) and Mr C. L. Blackburn (Merz and McLellan) in presenting a paper on the first stage of development of the Kariba Hydro-electric project. In the paper the problems which arose during construction and the methods of surmounting them were explained.

Series capacitors and stability

TRANSIENT BEHAVIOUR OF DOUBLE-CIRCUIT LINES

by S. P. R. Choudhuri, B.E.E., Dr. Ing.*

SERIES capacitors are being increasingly used on e.h.v. transmission systems as a means of improving system stability. The series capacitor provides capacitive reactance which partially compensates for the inductive reactance of the transmission line and so reduces the power-angle of the system, enabling power transmission under steady-state conditions to be increased.

To prevent damage to series capacitors by transient over-voltages, they are usually shunted by spark-gaps. This article shows how the transient stability of a double-circuit system is affected if, as a result of a fault on one circuit, the series capacitor in the healthy circuit is by-passed. From data obtained on a 400 kV, 600 MVA, 900 km transmission line, calculations have been made to determine the maximum permissible duration of the short-circuit across a series capacitor which will still allow system stability to be maintained. A general expression for the critical angle at which the capacitor must be brought back into service is derived.

List of Symbols

- H = Inertia constant of hydro station machines.
 $K = X_c/X_l$, degree of series compensation.
 P = Power transmitted.
 P_i = Initial power transmitted.
 P_M = Amplitude of power-angle characteristic under normal operation.
 t_1, t_2, t_d = Different times during the swing.
 $X'd$ = Transient reactance of generator/phase.
 X_t = Reactance of transformer/phase.
 X_l = Reactance of uncompensated line/phase.
 δ = Power angle.
 δ_0 = Initial angle of operation.
 δ_1 = Angle at which the faulty line is disconnected; capacitors in healthy line not in service.
 δ_c = Critical angle at which healthy line capacitors must come back in service.
 δ_i = Maximum angle of swing.
 Transfer reactance ratios:
 r_1 = normal/fault operation; double-circuit.
 r'_2 = normal/after fault; single-circuit and without capacitors.
 r_2 = normal/after fault; single-circuit and with capacitors.

Operation Under Fault Conditions

A fault occurring on one circuit of a double-circuit transmission line, particularly a three-phase fault, will result in a high voltage being applied across its series capacitor. Consequently, the capacitor protective spark-gap will break down. Since the double-circuit line is linked at each end, Fig. 1, a voltage sufficient to flashover the spark-gap will also be applied to the healthy line.

The faulty line will be rapidly disconnected by selective

operation of protective relays and its spark-gaps will quickly deionise after the arc is quenched. However, the spark-gaps in the healthy line will take longer to deionise because the line remains energised throughout the fault duration. During the arcing period, capacitive compensation for the line is lost and, if the arcing period is prolonged, system stability will be affected. It is, therefore, important to be able to derive the maximum time for which by-passing of the healthy line series capacitor can be permitted.

Curves are plotted for three different fault locations on the line, with power transmitted (initial power) represented as a function of the maximum permissible duration of arcing on the healthy line spark-gaps.

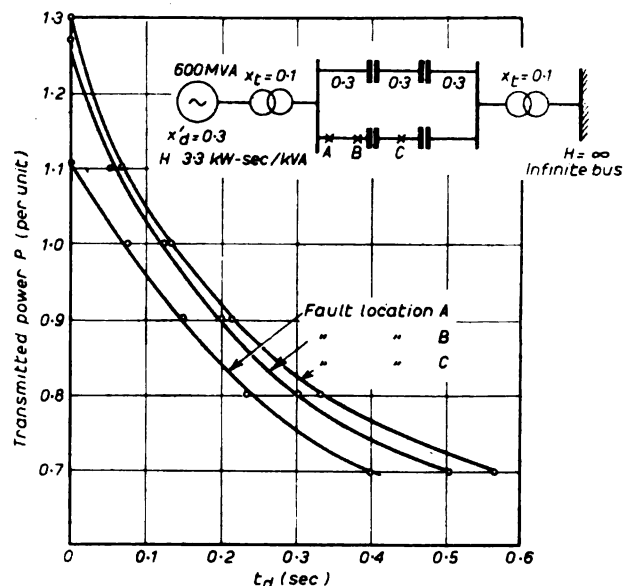


Fig. 1. Curve showing relation between "per unit" transmitted power and the maximum permissible duration for by-passing a series capacitor in a double-circuit line, to ensure system stability

Influence of Transient Stability

The system under investigation is shown in Fig. 1.

The condition to maintain the transient stability is obtained by applying the theory of "Equal Area Criterion" for stability.² For this purpose, four transient power-angle characteristics, Fig. 2, have to be used as follows:

1. During normal operation.
2. During the fault.
3. After clearing the fault, but during the interval when the healthy line capacitors are still by-passed by the ignited spark-gaps.
4. When the healthy line capacitors are again in service.

The equations of the four characteristics are, respectively:

$$P = P_M \sin \delta \quad (1)$$

$$P = r_1 P_M \sin \delta \quad (2)$$

$$P = r'_2 P_M \sin \delta \quad (3)$$

$$P = r_2 P_M \sin \delta \quad (4)$$

* Dr S. P. R. Choudhuri is a lecturer at the Indian Institute of Technology, Kharagpur.

Determination of the Critical Angle

The critical angle and maximum duration of capacitor by-passing are obtained as follows:

From the theory of "Equal Area Criterion," the area A_1 (Fig. 2) is equal to the area A_2 to maintain the transient stability. Therefore

$$(\delta_t - \delta_0) P_1 = r_1 P_M \int_{\delta_0}^{\delta_1} \sin \delta d\delta + r_2' P_M \int_{\delta_1}^{\delta_c} \sin \delta d\delta + r_2 P_M \int_{\delta_c}^{\delta_t} \sin \delta d\delta$$

or

$$(\delta_t - \delta_0) \sin \delta_0 = r_1 (\cos \delta_0 - \cos \delta_1) + r_2' (\cos \delta_1 - \cos \delta_c) + r_2 (\cos \delta_c - \cos \delta_t)$$

$$\text{but } \delta_t = \pi - \sin^{-1} \left(\frac{\sin \delta_0}{r_2} \right)$$

therefore

$$\cos \delta_c = \frac{\left[\pi - \delta_0 - \sin^{-1} \left(\frac{\sin \delta_0}{r_2} \right) \right] \sin \delta_0 - r_1 \cos \delta_0}{(r_2 - r_2')} - \frac{(r_2' - r_1) \cos \delta_1 - r_2 \sqrt{1 - \left(\frac{\sin \delta_0}{r_2} \right)^2}}{r_2 - r_2'} \quad \dots (5)$$

In the equation (5) for δ_0 , δ_0 is determined from the initial conditions and δ_1 is found for a given fault clearing time by "Point-by-Point" method of calculating the differential equation:

$$\frac{d^2 \delta}{dt^2} = \frac{\pi f}{H} [P_M \sin \delta_0 - r_1 P_M \sin \delta]$$

for the interval during which the generator rotor moves from δ_0 to δ_1 (fault clearing time t_1). Other quantities in Equation (5) are determined by solving the network for different fault locations; so that the angle δ_c can now be determined.

After clearing the fault, the time t_c corresponding to the angle δ_c is found by "Point-by-Point" method from the solution of the differential equation.

$$\frac{d^2 \delta}{dt^2} = \frac{\pi f}{H} [P_M \sin \delta_0 - r_2' P_M \sin \delta]$$

then

$$t_d = (t_c - t_1)$$

System Calculations

Data for a 400 kV, 900 km, 600 MVA transmission system are as follows:

$$X_d = 0.3 \text{ p.u.}$$

$$X_i = 0.1 \text{ p.u.}$$

$$X_l = 0.9 \text{ p.u.}$$

$$K = 0.6$$

$$H = 3.3 \text{ kW-sec/kVA}$$

$$\text{Base power} = 600 \text{ MVA}$$

$$\text{Base voltage} = 400 \text{ kV}$$

The calculations are for a fault clearing time (t_1) of 0.1 sec and for the fault locations A, B and C in Fig. 1.

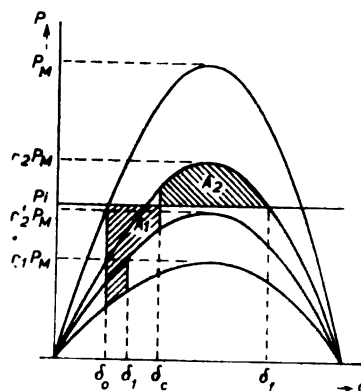
The curves of transient power stability limit, P , as a function of the maximum permissible duration of capacitor by-passing (t_d) are also shown in Fig. 1.

Conclusions

The curves, Fig. 1, show the maximum permissible duration of series capacitor by-passing in the healthy line as a function of the power transmitted. These curves can be used for designing suitable spark-gaps to give the permissible quenching times for given values of power transmitted while maintaining transient stability of the system.

The effect of decreasing the quenching time can be seen in the curve for fault location A. If the by-passing duration of the capacitors is reduced from 0.39 sec to

Fig. 2. Curves illustrating the four different power angle characteristics to be considered when applying the "equal areas" criterion to stability of a double-circuit line with series capacitors



0.075 sec, the transmitted power can be increased from 0.7 to 1.0, i.e., by 43%. The difference in the effect of by-passing for fault locations B and C is very small.

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N.J.A.C. Progress

JOINT consultation in the supply industry in England and Wales is examined in detail in the annual report of the National Joint Advisory Committee published, in most attractive form, last week. In a foreword to the report, Sir Robertson King, who is chairman of the NJAC, comments especially on "the success with which both generation and distribution Local Advisory Committees are tackling local problems." He remarks that electricity supply requires for success something more than technical and administrative efficiency: "It requires also a sense of mutual responsibility and fellowship in all who contribute to the service we provide."

It is generally agreed that the effectiveness of joint consultation rests on the performance of the 463 local advisory committees, 259 of them area board committees, 194 in the divisions, and the rest headquarters and project group organisations. Density of committees still varies considerably. At one extreme are LAC's which cover the whole of the sub-area of an area board; at the other, LAC's at small power stations. At the end of the period covered by the report, the typical committee had 15 members, of whom about five were nominated by management and the rest elected representatives of staff.

Efficiency was the subject most frequently discussed by LAC's during 1959-60. The national report speaks of evidence of general improvement of quality of discussion at meetings, and a wider recognition of the desirability of rounding off discussions with positive recommendations.

During the year reviewed, 119 suggestions were submitted for national consideration and 63 were circulated nationally for application where appropriate. Monetary awards totalling £4,235 were made under the suggestions scheme.

Electrical equipment of cranes

TORS IN DESIGN AND MAINTENANCE FOR SAFE OPERATION

Crane cranes have now been an indispensable part of workshop for many years. It is, therefore, not surprising to learn that they still fail to come up to standards of safety in so far as electrical control and equipment is concerned. Yet it is the Senior Electrical Engineer at the Senior Electrical Factories has, in his recent visit, found it necessary to review a number of problems which are reported and suggest ways of remedying them.

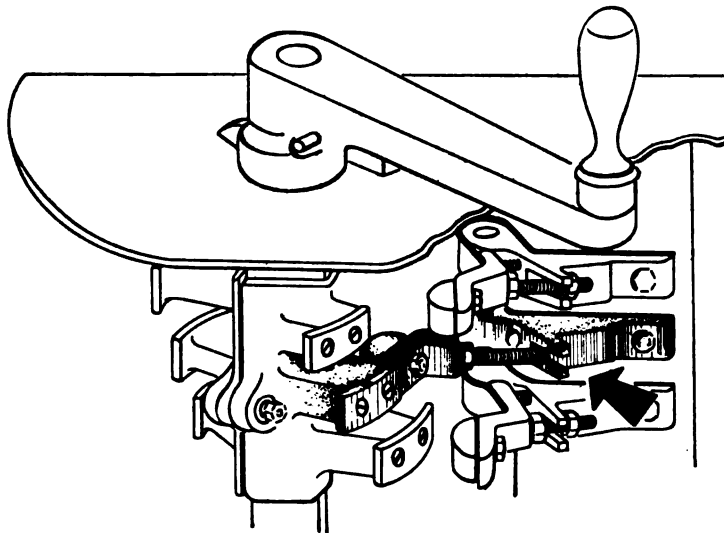
In a building crane, which has undergone radical changes in design over the years, the workshop types are still but little. Ranging from simple gantry types, capable of lifting up to 100 tons or more, to more controlled models, either rail or fixed, they all represent a shock hazard unless properly grounded and maintained.

Trolley Wires

On a gantry crane with a single hoisting motor, one and one cross-traverse motor, and from the cab, the first hazard is the trolley wires. As these are situated at the gantry remote from the cab, when they are adjacent to and over the cab where, unless they are protected, they are within reach. Another point where they are in his reach is at the access both of these points they should be protected by boarding that is accessible to the driver either through cab windows or when entering the cab.

Accidents and Their Causes, published by HMSO, 5s 6d. A general survey of this document appeared on 15 Oct. issue.

Slack or unlocked contact retaining nuts can result in a jammed controller



Similarly the collector wires and collectors supplying the hoist and cross-traverse motors on the gantry must be so placed that they are inaccessible to the driver should he have to go out on to the platform or to maintenance personnel engaged on other duties in the vicinity of the crane. Heavy gauge conductors on the larger cranes usually need metal mesh guards to provide adequate protection. These guards must incorporate substantial mesh material; chicken run netting will almost invariably suffer early damage or corrosion.

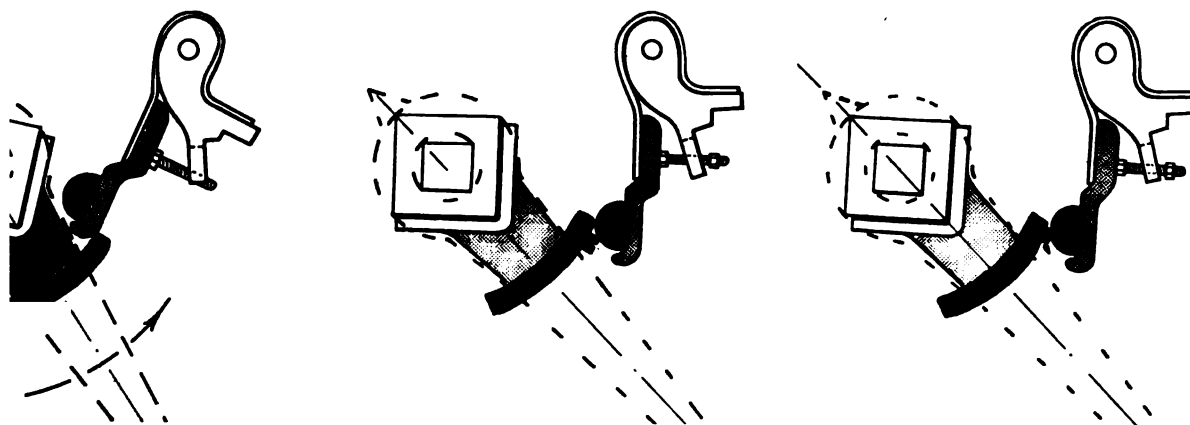
Catenaries and Cable Drums

Where movement of the crane is limited, insulated cables may replace the trolley wires. Tough rubber sheathed cables are used for this purpose which may be catenary wire supported—self-coiling cables are sometimes employed—fed from a spring-loaded drum on the crane or on the adjacent building structure or may even be trailed in an open

trough. Whatever the method employed, careful maintenance and frequent inspection of the cables and terminations is essential, as the risk of abrasion is by no means negligible.

Underfloor Conductors

In some cases, particularly in outdoor crane installations, the conductors or trolley wires are mounted in under-floor troughs with slot access. Apart from the necessity of frequent cleaning to ensure that drainage is unobstructed, the design of the slot must be such that the live conductors cannot be reached by metal bars or wires poked through the slot. An alternative design incorporates a steel strip covering the slot with a device which raises it only in the vicinity of the shoe to enable the collectors to contact the wires. Where trolley cables are accessible and are not amenable to full protective measures, the use of lower voltages, not exceeding 110 V a.c., is to be recommended.



contact faults. Left, a loose contact tip. Centre, a loose screw. Right, welded contacts. All of these can cause a jammed control and may lead to disastrous results

Drivers' cabs

There has been some improvement in driver's cab design in recent years, giving him better protection from draughts, comfortable arrangement of controls, improved seating and, of course, full view of and around the load being lifted.

It is desirable that the relevant positions and direction of rotation of the controls should be standardised throughout the factory, and the mechanism of the handles must be such that they cannot accidentally be moved from the "off" to the "on" position. Isolating switches on the cab should be provided so that the driver can make the crane "dead" before leaving. An additional isolating switch adjacent to the access point should also be provided to make the trolley wires dead for maintenance and cleaning purposes.

Limit Switches

Limit switches are provided at each end of the cross-traverse and long-travel and also at the upper limit of the hoist. The circuit must be so arranged that further travel in that direction is prevented without, however, preventing movement away from the limit switch. The switches themselves must be set to cut off the current and apply the brakes sufficiently early to allow for any over-travel through momentum. Buffer stops can be provided at the extreme of long-travel and cross-traverse, but are rarely applicable to the hoist.

Some crane drivers tend to rely on the limit switch to stop lift or travel and do not exercise sufficient care. This is a bad practice which should be curbed, but the design of the limit switches should be robust enough to withstand some amount of misuse. Co-ordination between brake adjustment and limit-switch setting is essential for good operation and, if the responsibility of two men of different trades, should be carried out jointly in a single operation.

Limit switches on cable drums will depend on the length of cable unwound for their operation though nominally related to the position of the gantry or carriage. If the cable should stretch, the adjustment will not prevent the gantry or carriage from meeting the buffer stops with some force.

Maintenance of Contacts

On all forms of controller the contacts are subject to wear and will eventually require adjustment or replacement. Care must be taken in this operation, particularly when the contacts are attached by screws, nuts and bolts or studs. The omission of a lockwasher or locking nut may allow the contacts to work loose with disastrous results. Some of the possible contact faults are shown in the diagrams on the previous page.

Floor-operated Cranes

Floor-operated cranes are, for the most part, controlled by push-buttons from drop lines. These drop lines have given a great deal of trouble and, at the very least, the supporting cable and the connecting cables should be separate. That is to say, the multi-conductor cable

should not, by itself, take the weight of the control unit.

Chain-operated switches, on the other hand, offer the hazard that they may be inadvertently pulled by passing loads, the operator tripping or through similar causes, setting the crane in motion. The controller should always incorporate a prominent mushroom-headed "stop" button which opens the main switch, making all circuits dead.

Lifting Magnets

Lifting magnets are used extensively in the steel industry for handling scrap and billets. The hazard here is of inadvertent failure of the d.c. supply to the magnet causing it to drop its load without warning. Single large pieces of steel

are more easily handled than which may tend to shed part of even when the magnet is fully Operators know this and take tions when handling loose scrap be caught unawares when handling pieces. The remedy is to float a —nickel type for preference—a magnet circuit which is kept automatically and which instant over in the event of a power

Maintenance of the electric ex of cranes is an important and re duty. It must be carried out at intervals and with full regard safety of the maintenance man. if the maintenance engineers are to take risks, what sort of exa they show to the crane driv operators?

ARC FURNACE TRANSFORMERS

NOW that more steel makers are installing arc furnaces, it behoves the maintenance engineer, if he has a say in the matter, to choose a transformer which will cause him the least anxiety. The arc furnace transformer does not differ appreciably from thousands of others which continue to give good service year after year, except in the matter of off-load tap changer operation, the tap changer operating some ten times during each melt. Thus it is rather a vulnerable piece of equipment, although not all faults in the tap changer are dangerous ones. However, only a slight misalignment between the tap changer position and the interlocks will prevent the circuit-breaker closing.

The position of the tap changer is therefore most important; it should be situated towards the top of the tank immediately under the inspection cover, or as near to this position as is practicable, so that it is only necessary to remove a small amount of oil in order that the cover may be taken off and the fault remedied. With the tap changer situated lower down in the tank, hundreds of gallons of oil may have to be removed and the heavy cover plate manhandled before the tap changer can be reached and worked upon. It is extremely annoying to have to spend all this time in order to deal with a fault that can be rectified by the tap of a hammer or the turn of a spanner, a matter of a few minutes' work.

The tap changer itself should be no more complicated than a manually operated crane controller and the interlocks should be simple, with plenty of positional latitude. It should not be necessary for the driving motor to stop dead in order to avoid an over-run.

Oil in the tap changer should be as separate from the main compartment as it is possible to make it, without going to the limit and making the compartments entirely separate. In this way, any carbon contamination of the tap changer oil is not circulated around the main transformer windings.

The most dangerous fault which occurs on a tap changer is bad contact, which

leads to sparking and conta of the oil. This could, in a n days, or even hours, cause a shut down. If the oil is common transformer and tap changer the is deposited in the c.h.t. windi even if these windings do no down at the same time as changer they are almost certain so at a later date, since it is in to remove the carbon deposits

Some transformer manu recommend that the oil be drain the transformer every 12 and an inspection made of changer. It is difficult to see w will achieve. The comprehensive a sample of oil taken from th former tank gives quite a picture of the transformer condit apart from excessive acidity, should not require to be change than ten years. An annual inspe the tap changer will be little us because the chance of forest fault which can only last a f when it develops is very remote from this, to remove and store th of gallons of oil in a clean, c dition is a major operation.

A bad contact in a circuit steady load would be detected by the fluctuating ammeter read the violent fluctuations of curre are a feature of the arc furnace a fault in the tap changer being in this way.

The answer to the uncertainty condition of the tap changer see the fitting of a toughened glass the side of the tap changer comp This would allow constant inspe the oil condition from floor lev a short period of sparking will the oil, so that a fault could be in the early stages and, if changer inspection lid were pl the top of the tank, quickly rem

The maintenance engineer sh have to accept any responsibility breakdown of the arc furnac former if he has taken regular of oil and has had them tested b petent authority.—L. Smith.

Aspects of Automation

BRITISH TECHNIQUES DISCUSSED IN MOSCOW

Moscow this summer, a meeting held of the International Federation of Automatic Control. A number of papers were presented at this meeting recently these were considered aposium organised by the Institution of Mechanical Engineers.* Many of the papers are concerned with highly technical aspects of automatic control but there are a number which give an intriguing picture of the way automation is developing in British

The steel industry has been amongst the most active exploiters of the possibilities of automatic control. An example of ingenious instrumentation that has been developed is the strip width measuring device of which are in operation. The performance given is an accuracy of ± 0.030 in. with range of movement 3 in. to 24 in. on a hot-tilt. The instrument is rugged to permit mounting the follower only 6 ft above the fast-moving strip. Fig. 1 shows the basis of the instrument. Two photo-electric edge units are mounted vertically opposite edges of the strip. In conjunction with the optical system, there are two-operated shutter edge auto-following the hot edge of the two edges are monitored and added to indicate width of strip, independent of the inevitable shake makes more static methods of measurement impossible. The instrument is capable with 6 in. movement of each the strip in a lateral direction.

A more sophisticated is another technique under development for measuring strip speed in strip mills. This involves sharply defined intense spots directed on the moving surface, with the direction of motion, and from the surface into phototubes. The varying texture of the surface produces varying signals from the phototubes. The signal from the upstream phototube is delayed and then compared with the signal from the downstream cell, a delay found at which the two waveforms are in step. This delay is a function of strip speed. So far, experiments that with cold-reduced steel an accuracy of $\frac{1}{2}\%$ can be achieved in the range 100 ft/min to 1,000 ft/min. A servo system to control the timing could give direct reading of

equipment. An example of the taking over of a highly skilled but monotonous manual job comes from the bicycle manufacturing industry. The task is the building of a bicycle wheel. This involves tightening the spokes by nipples fixed to the hub and rim of the wheel, with tensions in the spokes adjusted so that the wheel runs true. Spoke tension has to be made high enough to prevent distortion of the wheel in service, but not so high that breaking occurs under the working load.

female labour to be used to produce one wheel every minute.

Position Control

Much of the work on automation has concerned position control of machine tools. Amongst the Moscow papers was a description of the Helixyn system, in which a cylindrical bar, somewhat longer than the distance over which control is required, is used, surrounded by a short cylindrical sleeve which moves along the bar, but not in contact with it. The two parts are mounted on the machine tool so as to pick up the relative motion which is to be controlled

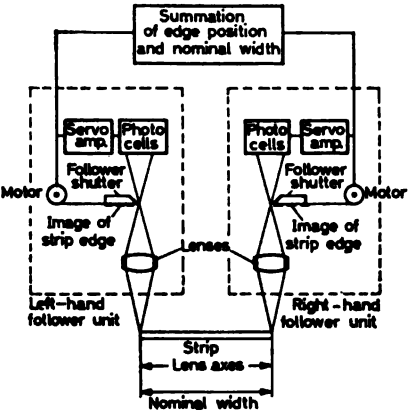
The sleeve consists essentially of a tube of insulating material, the inside surface of which supports four distinct helical conducting paths. These are arranged with equal axial spacing so that they form a regular interlaced pattern. The bar has three interlaced patterns carried on a layer of insulation bonded firmly to a steel tube. The lead of the helices on the bar is the same as that on the sleeve and the design is such that variation in capacitance between each sleeve conductor and each bar conductor is closely sinusoidal when plotted against relative axial movement.

In use, the sleeve conductors are supplied with a.c. or impulse voltages at a sign and magnitude set by a relay-switched resistor network. The switching is controlled by numerical input from a keyboard or punched tape) and operates so that the electrostatic field between bar and sleeve remains substantially constant in form but takes up an axial position relative to the sleeve, bearing a linear relation to the numerical input. The result is an order of accuracy of positioning of 0.0001 in.

Control in Sugar Production

In the chemical industry, automatic control has been carried to the point where complex operations are under computer control. An example is processing sugar beet. Here the rate at which various stages of the process are proceeding is adjusted to keep intermediate tanks full to a pre-arranged level. Electronic computers are used and they take account of the time constants associated with the various stages of the process to keep the work proceeding steadily.

Papers mentioned above are those by Messrs L. N. Bramley, S. S. Carlisle and R. B. Sims (steel); A. V. Hemingway and R. L. Dressler (bicycle wheels); D. J. Mynall (position control); and J. Campbell MacDonald (sugar processing).



Schematic diagram for steel hot strip width measurement

In the automatic machine, the wheel is held in a jig and a measuring head operating with reference to the rim of the wheel is fixed by an arm centring on the hub. Each of the spoke nipples is introduced into a box spanner, each box spanner having its own driving motor. The measuring head contains two double-wound U-shaped laminated cores with the primaries excited at 400 c/s. One head measures the gap in the radial direction, the other the gap in the vertical direction (the wheel being held horizontal) and, hence, the deviation of the rim from the rotational plane of the measuring arm.

Once the wheel is set up the arm rotates and signals representing the rim positions in the two planes are developed. These signals control the running of appropriate motors, non-circularity being dealt with by tightening spokes to reduce the immediate radius, distortion in the plane of rotation by tightening spokes fixed to one side of the rim only. The machine also includes provision for tightening all spokes at stages in the cycle, so that none are left entirely slack. The spanner-driving motors are arranged to stall when maximum acceptable spoke tension is reached.

This machine has enabled unskilled

Wheels

A high degree of mechanical control is involved in some automated

papers presented to the Moscow conference, foreign as well as British, are published by Butterworth's Scientific Publications Ltd.

Ergonomics in Industry

THE MODERN APPROACH TO GREATER PRODUCTIVITY

ERGONOMICS—the study of man in his working environment—is a comparatively new science. It springs from the earlier sciences of work study, industrial psychology and industrial design in relation to machine tool layout, workshop planning, lighting and décor. In fact, it may be considered as the combination of all these sciences into a co-ordinated study.

The new science first received its impetus during the war when the design and use of service equipment became vitally important. In the post-war period it has developed considerably, with striking results on productivity and the general health and well-being of workshop and office personnel.

The Scope of Ergonomics

Any productive process may be considered as the co-ordination of machine and operator capacities within a shell of environment. Both environment and machine are capable of being designed, planned and adjusted within almost infinite range; operators, on the other hand, have capacities which are limited by their personal physiques, mental capacities and other factors which are incapable of alteration or adjustment beyond that of stimulating latent abilities by training or education. It therefore follows that the operator is the governing factor in a productive process. Once the parameters of physiological and psychological requirements for a particular task have been set and the operators chosen who possess these requirements, the ultimate output from the machine-operator combination will depend largely upon the degree of skill with which the control functions of the machine are presented to the operator and the environment in which he is working.

There are certain factors which are broadly complementary in the man and the machine. The link between them is the controls. The maximum capacity of the machine in size and weight per work-piece is complementary to the physical strength of the man; the sensitivity, accuracy and consistency of repetition of the machine is complementary to the psychological make-up of the man, his mental capacity, keenness of perception and response to mental stimuli. Both man and machine are subject to a fall-away in performance which may be temporary—adjustable wear in the case of the machine; fatigue in the case of man—and rectifiable by a short period

of rest and maintenance, or permanent through age.

The performance of the machine may suffer through environmental factors, such as the presence of corrosive atmospheres, dust and grit and, in some cases, excessive atmospheric humidity and temperatures. The complementary environmental factors in the case of the man are lighting, ventilation, outlook, attitude and noise.

The ergonomist, appreciating these factors, strives to link the operator with the machine in such manner that he is able to exercise control with the minimum of physical and mental stress and to so arrange the environment that the productive effort may be maintained for the longest periods without excessive fatigue. These broad principles apply whether the machine is a relatively simple tool, such as a pair of scissors, a complex machine tool with simultaneous control in two or more directions at differing rates or the even more complex task of controlling and navigating a high speed aircraft. The tailor, working at the cutting-bench, uses scissors which have been designed to fit the hand comfortably and with blades cranked at the most convenient angle; their continued efficiency as a cutting instrument depends on the maintenance of sharpness at the cutting edges and on the degree of wear in the rivet and rivet-hole.

Ergonomics Research

In Britain the study of ergonomics is centred in the Ergonomics Research Society.¹ This body was formed by a group of research workers who, during the war, had been members of teams formed to study physiological and psychological methods for the best means of measuring fighting efficiency, safety and comfort of all forms of combatant under varying conditions of environment. The groups included anatomists, engineers, physiologists, psychologists and industrial medical officers. At the end of the war the teams were broken up but in 1949 some members met to discuss research in this field and, at the meeting, it was decided to set up an organisation to carry on the work with particular application to industry. The term "ergonomics"—from the Greek "Ergon," work, and "nomos," law—was coined for the new study.

The Society has the close co-operation of, and works in association with, the DSIR, the Medical Research Council, the Universities and many industrial research associations. It was the Society which requested the DSIR to promote the recent Conference on Ergonomics at which industry was shown some of the

results of recent research and how the results were being applied to a wide variety of industrial problems. Lord Hailsham, Minister for Science, opening the conference, referred to the basic ergonomic study of "time and motion" and stressed that the degree of industrial unpopularity which was accorded to it was primarily due to the limited range of the study. Today the TUC is one of the strongest supporters of ergonomics.

The Human Factors

The human factors can be broadly divided into the allied physiological and psychological groups of study. Psychology is a wide subject of which one aspect, covered by the term "experimental psychology," is the concern of the ergonomist. This study relates to man as a control mechanism taking in information and using it to guide his actions. The psychological aspect of fatigue has little connection with muscular fatigue and its effects are different. Whereas muscular fatigue leads to loss of performance and erratic, nervy behaviour, the psychological counterpart, boredom, leads to loss of vigilance and/or drowsiness. Boredom can, however, be dissipated by novelty or change of aim. Some of the most strikingly boring jobs are those which under-load the operator but never allow him time to divert his attention to other things.

This aspect may have some bearing on the reason why some light repetition tasks are particularly suited to women. The lesser degree of physical demand tends to create a sense of boredom in the more physical male whereas a similar repetitive task, such as operating a capstan lathe, calling for more muscular effort does not have the same effect.

The psychological factors are also of importance in the relations between individuals. For complete accord, there must be some common pattern of observation, interpretation and translation of information into action. Upon this will depend the accuracy with which an instruction, verbal or written, from one person to another will be carried out.

Sometimes a simple instruction is difficult of understanding without some background knowledge to assist. Welford quotes an example of training girls in so-called "invisible mending" on woollen materials in which the pattern of weave is faithfully copied. The training period seemed unduly long until the idea was conceived of showing the girls how the weaves were originally constructed. The girls were enabled to construct the weaves on a large frame and to do the first mends on specially woven large scale cloth. The reduction in training time was dramatic.

¹This article is based upon a series of papers presented at the DSIR conference on "Ergonomics in Industry," London, 27-29 Sept., 1960.

The Physical Aspect

Most people think that they have an idea of what constitutes physical work. The common impression that muscular energy is used only when some form of motion is in progress is incorrect. Try holding a heavy weight at arm's length for a long period and you will soon experience muscular tiredness. There is, for every muscle, a position at which the demands for energy are at a minimum. A knowledge of this in relationship to the positioning of the control is important in combating muscular fatigue. Murrell mentions an incident in which the angle of an accelerator pedal of a car was set so that, for the idling position, the ankle was bent backwards some 20° from the natural position. The result was early muscular fatigue resulting in a tendency to drive the car faster than road conditions warranted.

Another aspect of physical fatigue arises from the disturbance of normal working cycles. The changeover from day to night shift working is accompanied by a falling off in output until the body has accustomed itself to the new cycle. This may take 4 to 5 days. Practically all muscular fatigue can be reduced by intermittent rest periods and the timing of operations to include properly proportioned rest periods from muscular effort, without necessarily breaking the mental effort, can have surprising results on output. Both physical and psychological fatigue are dependent on environmental conditions and one in particular, the attitude or position of the body, whether sitting or standing, is of vital importance. This is part of the extensive anthropometric studies which have arisen out of early investigations into the most satisfactory attitude for pilots and crew of aircraft, drivers and gunners of fighting vehicles, submarine crews and other service personnel during the war.

The same study, projected into industry, is of vital importance to the designer of office furniture, the planning of control positions in vehicles, crane cabs and before control desks. The anatomical and physiological principles have been well studied and are taken into account in British Standard 3044 on school furniture. The same principles have equal importance in industrial design.

Despite mechanisation, there are still a surprisingly large number of locations in industry which demand muscle power from the seated position. The limits of effort available and the angles at which the force can be applied without exceptional fatigue must be known to the designer, and a great deal of study has already been given to the subject. In lifting operations, the amount of effort which can be applied from the standing position is considerable. Unless the limiting loads for the individual are known, there is danger of back injury which, in the case of young people and women, is prescribed by factory regulations.

Ergonomics and Design

It follows that the studies of the psychologist, physiologist and anthropometrist are of vital importance to the machine designer. It is common to talk of the "average" man but, as Weiner says, the anthropometrist does not cater for the average man. There is such a measure as an average value but almost no such thing as a completely average man. For any individual measurement perhaps 20% to 25% of a population might be said to congregate at the mean but, of these, only a fraction would be average in another dimension. The anthropometrist's solution is to use two mannikins—simple models with the main measurements—to cater for 90% of the range which are combined with photographs to make sure that posture and movements from the control position are correct.

Many of these measurements are tabulated with mean and standard deviations and the information is invaluable to the designer but, for the moment, they exist only in widely scattered monographs and reports; a handbook combining them would be of immense value.

Another aspect of machine design is the positioning and grouping of the various indicators which give the operator the information on which he makes his decisions. It is fundamental that the associated indicators and controls should be so grouped in relation to each other that the minimum of mental effort and physical movement is exerted in identifying the message and making the appropriate action. Equally important but less obvious is that there should be relation between the movement of the indicator needle and the related control handle.

For handwheels associated with circular scales, clockwise movement of the indicator needle should correspond to clockwise movement of the control wheel. Other relationships also commend themselves to the thinking designer.

On the subject of grouping, where a large number of indicators are mounted together, sub-grouping into related sections is an aid to easy location. In regard to the form, shape and colour of the indicators and the size and style of the markings, Spencer, in his paper, makes practical recommendations on the strength of a study carried out at Reading University.

Three basic designs are included in the study; moving pointer, moving scale and cyclometer. Merits differ and the choice depends much on the application and location. The main features, however, are that black and white are the best for scale marks and background, with upright figures in a non-serif style, and the minimum number of scale divisions compatible with the duty. The machine designer and the furniture designer of the future must both be influenced by the work of the ergonomist for the industrialist, seeking higher productivity against an ever increasing

wage scale, will find even the smallest detail which assists in increased output a factor influencing his choice of machine.

Environment

Of the five factors mentioned under the heading of environment, attitude of the operator and noise are largely the responsibility of the machine designer. Outlook and ventilation are the responsibility of the architect, who also has some responsibility for noise in that he will decide the form and material of ceilings and wall claddings.

Lighting is a feature of the environment which is not easy to correlate directly with productivity. There is, however, good evidence that better lighting is a factor in improved productivity; certainly poor lighting in the workshop or incorrectly applied lighting greatly increases scrap.

Lighting Principles

The three main principles to be followed are that there should be adequate lighting without glare; that there should be freedom from unwanted shadows and that the work should be the natural focus of attention.

Controlled laboratory tasks have provided a great deal of useful information about lighting levels but the translation into industry must necessarily involve experience as well as experimentation. Recommended levels for most industrial tasks are of the order of 15-50 lumens/sq ft, with the lower figure as the minimum regardless of the type of work in hand.

Glare is one of the most worrying problems in factory lighting today. It can offset the advantages of a well planned lighting installation in other respects and the raising of the illumination levels to such an extent that the better lighting produces a lower output. It may be caused by the direct impingement on the vision of a light source or the reflected image from polished surfaces on or around the workpiece. It reduces the ability of the operator to read his instruments with accuracy, but it may be present without any reduction in his ability to see nor may he be directly conscious of its effect upon his vision.

The problem is complex but the means of avoiding glare have been studied and are well understood. The whole environment must be bright, which means that the surfaces of walls, floors and ceilings are light in colour. Matt finish paints are preferable to prevent reflected highlights and the surfaces should be washable so that the diffuse reflecting qualities are maintained.

The work should be the natural focus of attention. Anything about the work which demands special attention should have local lighting, but local lighting in an otherwise poorly lighted area is bad. This is a common mistake which has frequently been made in the past. Too great a contrast between the light on

the workpiece and the surroundings is liable to induce eye-fatigue, since the constant transfer of the gaze from one point to another will be accompanied by excessive dilation and contraction of the iris in the eye. There must be a proper balance, giving just sufficient contrast to enable the gaze to be transferred from the work area for visual relief without excessive call on eye muscles.

Small workpieces under bench-mounted processes need particular treatment. There must be contrast between the workpiece and the bench surface background. Some reflected highlights from the surface of the workpiece are unavoidable, and, indeed, are advantageous to provide degrees of contrast, but the level of such highlights must be controlled. Since eye response is a variable with different persons, there is something to be said for adjustment of the local bench spotlighting by the operator.

In regard to general lighting, the fluorescent tube has revolutionised factory, office and shop lighting to an extent unimaginable 25 years ago. The rules for height and spacing have now been fully established and the minimum levels at the working plane are laid down in various statutory regulations for factories which reflect the advances in this field. It is important to remember that the levels are minima and are conservative. Factory lighting which only just observes these minima cannot be considered as a good, or even adequate, installation by modern standards.

The P.S.A.L.I. Concept

Not all lighting is from artificial sources. Wherever possible, natural daylight is used, not only because of its effect on lighting bills but because the human preference is for natural daylight where possible. The modern concept of factory and office buildings with large window areas is a recognition of this, for the average worker prefers a window position for his or her desk or bench. Natural light is, however, far more variable in quality and intensity than artificial light and needs some form of shading during the height of summer or in the late autumn and spring days when the sun is low on the horizon. At the other extreme, on cloudy or foggy days, some assistance from artificial lighting is essential.

In large buildings, where the floor area extends well back from the windows, natural lighting by itself, even on the sunniest days, is inadequate and must be supplemented by artificial lighting. While the American idea of a totally artificial indoor environment, excluded from natural light and ventilation, is not likely to appeal to the British people—perhaps because our climate is not so extreme as in many parts of the American continent—some permanent daytime lighting will inevitably be part of the future modern office or factory installation.

This aspect has already achieved some attention and the concept of mixed natural and artificial lighting has been

studied at the Building Research Station and the elements of a basic mixed lighting system—PSALI, permanent supplementary artificial lighting for interiors—are now established. Fully developed, it may mean a reduction in the window areas below the present purely architectural levels and an increased amount of permanent artificial lighting to produce an evenly balanced overall illumination throughout the day.

The whole subject of lighting is a major study in which the lighting engineer and architect play complementary parts. As a major factor in productivity it is part, but only part, of the ergonomic pattern. It can neither be excluded from, nor considered as separate from, the general plan of the ergonomist's study.

Ergonomics in the Factory

Many industries have already taken ergonomic studies seriously. In the steel industry an ergonomic approach to the problem of heat stress in rolling mills and furnace rooms has been made by the Climatic and Working Efficiency Research Unit of the Medical Research Council. They discovered that a rise of only 2°C in body temperature was sufficient to cause a serious falling off in performance of physical and mental work. Applying this to the conditions existing in steel works and foundries they have established that the forms of heat stress which are responsible for rises in body temperature are atmospheric and radiation from the hot billets and open furnaces. The former is accompanied by humid conditions in many cases which prevent evaporation of the sweat with consequent rise in body temperatures. This could be cured by better ventilation but, where radiant heat is concerned, ventilation is inadequate in combating the condition since the rays pass through the air. The answer is to provide heat screens comprising a sheet of thermal insulation covered on the side facing the furnace with polished aluminium foil. In some cases protective clothing incorporating reflecting outer surfaces could be used.

Repair work on recently closed down furnaces, Bessemer converters and soaking pits requires different treatment. The operators are surrounded by surfaces at close to red heat and, without protection, can only work for a few minutes at a time with long rest periods between. Protective clothing and helmets of thermal insulating materials with inbuilt air cooling—a legacy from supersonic aircraft pilot's clothing design—is being developed for such locations.

Another point which the ergonomists have brought to light relates to the modern practice of grouping controls at a central point remote from the process. At first sight this might seem to solve the fatigue problem in that physical effort is reduced considerably by centralisation of observation. In point of fact the operator now has to visualise an operation in terms of the mimic displays and indicators instead of actually watching the operation, with all the minor indications which assist him in his

judgment. The mental processes involved in translating the numerical values and positions on the indicators into a picture of the actual conditions represents a considerable psychological load. In fact, the physical stress has been transformed into substantial perceptual and decision-making load which is just as much responsible for fatigue as manual labour. But that is only one aspect of centralised control.

Ergonomics in Transport

London Transport is another organisation which has benefited by applied ergonomic studies. The study has been particularly applied to the cab design of buses and underground trains. Attention has been given to such details as steering wheel rake, pedal travel, position and angle of footplate, seat position and seat squab shape. It was found that many of the accepted layouts in the past did not conform to the required standards as disclosed by the survey and, in the final evaluations, the assistance of the drivers themselves was sought for their views of the proposed arrangements. Not only did the latter give their wholehearted co-operation, but suggested other improvements which have contributed to better and less fatiguing driving positions.

This incident shows a clear distinction between ergonomics and the earlier attempts to launch time-and-motion studies. Whereas time-and-motion studies in the past have not always received the support of industrial workers and in some instances, have been violently opposed, ergonomic studies, by their broader and more encompassing aspects, have invariably secured industrial co-operation at all levels. It is a long cry from the initial work of Frank and Lillian Galbraith who, some 50 years ago, launched their ideas on work study to an incredulous world. Part of the opposition may have been due to the errors of psychology in presenting the techniques to the worker in industry but, since psychology is part of the ergonomic study, it is natural that presentation of the idea is based on the right psychological approach.

Ergonomics is still an infant science. The spade-work is, however, beginning to show interesting results. Lectures and courses which have been fostered by the Society since 1957 have shown increasing attendance. To date more than 20 companies have sent men on courses and the interest and enthusiasm gains impetus from year to year.

One cannot, of course, cover the vast field of ergonomics completely in a few pages, but sufficient will have been said here to indicate that the new science bids fair to becoming a powerful influence in the industry of tomorrow.

REFERENCES

1. The Ergonomic Research Society. Chairman: Thos. Bedford, O.B.E., B.Sc., Ph.D., M.I.M.E. General Secretary: O. Edholm, M.B., B.S., B.Sc., M.R.C.P., L.R.C., Medical Research Council Laboratory, Holly Hill, N.W.3.

Industrial electrical drives

CHAIRMAN'S ADDRESS TO I.E.E. UTILISATION SECTION

IDELY used in industrial fabrication processes, variable-speed drives, together with their control systems, offer the biggest scope for technical improvements amongst industrial electrical systems. It is, in this field where most recent advances have taken place. This point is made in the inaugural chairman's address to the IEE Utilisation Section by Mr J. M. Wilson, B.Sc.(ENG.), M.I.E.E. (EE Co.). Constant speed drives are, in the main, catered for satisfactorily by the squirrel-cage induction motor. The advantage of its low cost over other motor types is illustrated in Fig. 1. The basic design of the squirrel-cage motor would appear to have reached the ultimate and development is confined to increasing ratings and provision of special enclosures for special duties.

Variable Drives

For variable-speed performance, the position of the d.c. motor is still unchallenged. Over the years there has been change in its basic concept, rather a gradual evolution and refinement in design. There remains, however, the standing commutation problem and much research has been carried out towards overcoming this major disadvantage in d.c. motors. The problem has been aggravated by high rates of change of current imposed by modern control systems. In motors having cast-iron or rolled-steel cores, slow response of main and compole flux, due to eddy currents, has an adverse effect on commutation. This difficulty has been overcome by introducing laminations with laminated frames. Parallel to improvements in d.c. motor design, there have been new trends in a.c./d.c. conversion. The traditional thyristor converter used for d.c. motor control is beginning to be superseded by static converters. An interesting application is in regenerative drives for reversing mills as an alternative to the universal Ward-Leonard or Ilgner systems. Use is made here of a grid-controlled mercury-

arc converter. Regenerative reverse currents are catered for by connecting duplicate installations back to back, or by placing a reversing switch either in the drive motor armature circuit or its field circuit. These connections are shown in Fig. 2. Static converters are also used in packaged power units which provide variable output drives up to 100 h.p. from a 400 V a.c. supply. For these units, increasing use is being made of silicon and germanium rectifiers.

Variable-speed Induction Motors

The inherent simplicity and robustness of the induction motor has attracted attention to the possibility of adapting it for variable-speed applications.

One line of attack has been to provide an economic variable-frequency supply source. An example of application of this principle is at Hinkley Point nuclear station, where the carbon dioxide coolant blowers are driven by squirrel-cage motors supplied from a variable-speed turbo-alternator. Other development work on variable-speed induction motors has been concerned with basic design, with the investigation of such techniques as pole changing, stator phase shifting and the use of series reactors.

Control

The value of automatic and semi-automatic control of industrial processes is now clearly recognised and, with the advent of magnetic and transistor amplifiers, the reliability of electronic systems has been proved in practice and is no longer doubted. Many industrial processes lend themselves to automatic control where operations are programmed on punched tape and fed into the system. There has been a recent trend in this direction backed by experience gained in semi-automatic control. Future developments are expected to be in the exploitation of digital computers for automatic supervisory control.

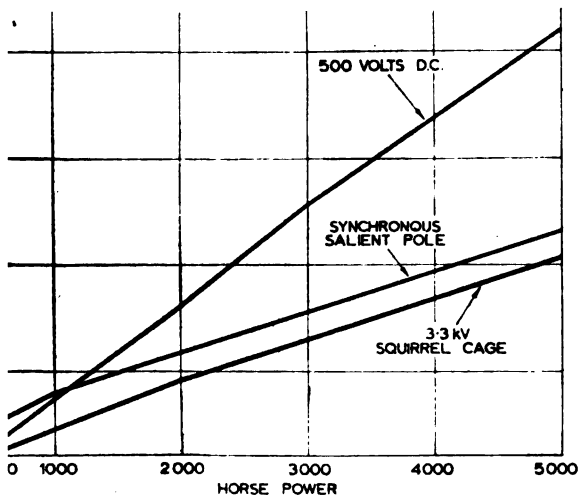


Fig. 1. Relative costs of motors operating at 1,000 r.p.m.

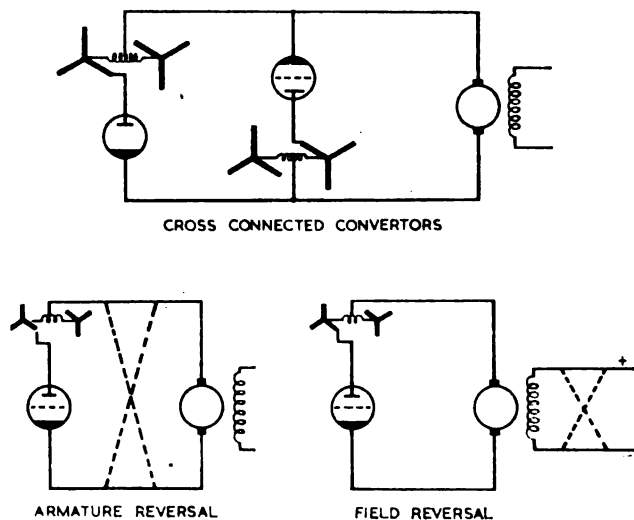


Fig. 2. Systems for reverse current flow with mercury-arc converters

for the electrical trade

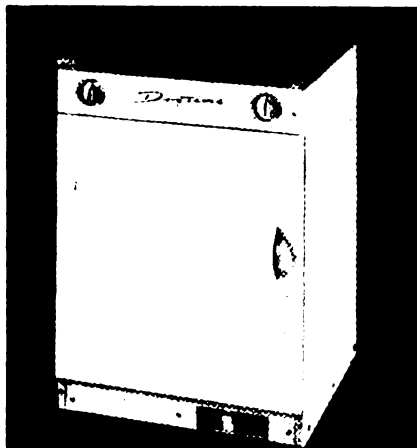
Inexpensive tumble dryer

A TUMBLE dryer with three heats and automatic time control seems good value at £34 13s tax paid. The machine offering these features is "Drytime," a 7 lb capacity model 30 in. high with a flat table-top in red, blue or white. The main square door allows access to the horizontal perforated drum and operates a cut-out device and brake immediately it is opened.

The simply operated controls situated on top right and left of the front panel give three heats, up to 2 kW output, and a drying time of 90 min maximum. "Drytime" has a finish of white stove enamel and stands on three casters. Dimensions 30 in. high by 21 in. wide by 19½ in. deep. Eight feet of flex and a 6 ft extractor hose are extras. This machine is covered by a year's guarantee and after-sales service. *Wallisdown Electrical Appliances, Wallisdown Rd, Bournemouth.*

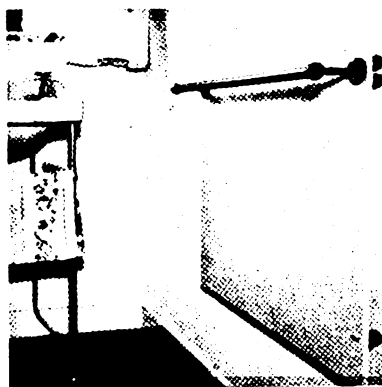
Household fire alarm

HOT air from an unseen fire will set off the new battery-powered "Cry-er" alarm when the temperature approaches 140°F. This warning device is designed for domestic installation; it is small, inexpensive and attractively styled. The alarm is simply hung on the wall at a "high spot" in the house where hot air, convected from a fire, would have to pass. The makers recommend one on each floor for complete safety. Powered by two batteries, it produces a wailing sound loud enough to rouse everyone in the household. If good leakproof batteries are employed "Cry-er" should carry on sounding,



"Drytime" tumble dryer, 3-heats and time control, £34 13s

once activated, for up to an hour. Operating on the bi-metal strip principle it resets automatically once the temperature has dropped and, provided the emergency has been only short-lived requires no further attention apart from a monthly check. The smoothly styled casing measures only 6 in. by 3 in. It is available from stock at £3 19s 6d. *Fire Cry-er Ltd., Jack Bridge Mill, Colden, Hebden Bridge, Yorks.*



"Neptune" towel drying panel, £9 9s

The 'fridge as furniture

THE refrigerator as a domestic kitchen appliance is not necessarily a fixed concept, as Tricity have shown with their new "Diner-cold" model. Designed expressly for installation in a dining room, this refrigerator resembles a double-door cabinet in elegant sapele wood. It is, however, a Tricity 4.2 cu ft refrigerator encased in highly polished panels of wood, with an ordinary left-hand opening door. Finished in polished polyester coating it looks perfectly natural among other more traditional dining room pieces and is, in fact, an attractive article of furniture itself.

Tricity believe that their new style refrigerator will be welcomed by households where kitchens are not large enough to take a model of so great a capacity. Obviously, this is not its only application and there is no reason why a "dining room refrigerator," as distinct from the kitchen type, should not evolve as an accepted piece of equipment from Tricity's latest idea.

Known as "Diner-cold," the new refrigerator is identical internally to the ordinary 4.2 cu ft, but has attractively designed flaps covering the freezer, fats rack and door compartments, each

Warm panels for wet towels

HEATED wall-mounting panels with towel rails are a recent addition to the range of heaters employing the "Mhoglass" mesh-type element. This is an ideal application of the "Mhoglass" element which is rated, so far, at less than 100 W/sq ft. The towel dryer comprises two Swedish masonite boards sandwiching the element and finished in pink, blue or cream stove enamel. The towel rail is placed toward the top of the panel. An output of 300 W is said to keep towels dry and possibly takes the chill off the bathroom. Dimensions: 2 ft by 2 ft. Known as "Neptune," the dryer is simply installed with the fixing accessories supplied. Price £9 9s tax paid. *Morheat Ltd., Church Path, Fareham, Hampshire.*

TBAADE PUBLICATIONS

CAMPLEX.—Leaflets describing electric seed propagator and fluorescent fittings for plant irradiation. *Simplex Dairy Equipment Co., Cintra Hse, Cambridge.*

SIMMS.—Leaflet describing six new products introduced at Commercial Vehicle Exhibition, 1960, by Simms Motor Units Ltd., Oak La, East Finchley, N.2.

MORGANS.—Leaflet TD 23, "Crusilite Tube Furnace." *The Morgan Crucible Co., Battersea Church Rd, S.W.11.*

CAV.—Technical leaflet describing panel lamps. *C.A.V. Ltd., Acton, W.3.*

PYRENE.—Sales information on Bulletin No. 5 of the Metal Finishing Division. *Pyroclean No. 104 cold soak type cleaner. The Pyrene Co., Metal Finishing Division, Gt. West Rd, Brentford, Middx.*

NEGRETTI.—15-page catalogue B21 describing air-operated receivers. *Negretti and Zambra, 122 Regent St, W.1.*

appropriately labelled. "Diner-cold" has a "Tecumseh" compressor unit, guaranteed for five years. Dimensions: 36 in. high, 22½ in. wide and 25 in. deep. Price £75 12s. *Tricity Cookers, Thorn Hse, Upper St. Martin's La, W.C.2.*



Tricity's "Diner-cold" looks perfectly natural in the dining room. Price £75 12s

equipment for industry

ionisation-type u.h. vacuum gauge

PENDING upon the ionisation current principle a gauge for measurement of ultra high vacuum consists of an Alpert type gauge head, a solenoid unit and an ionisation current amplifier. The gauge head, series IG-3, has a nominal sensitivity of 12.5 mA per mA emission and permits measurement down to 5 by torr, which is the soft X-ray limit. The control unit provides stabilised supplies of filament and emission current, electrode potentials and degassing on bombardment up to 100 W. Signals from the gauge head are amplified and appear as voltages on a chassis-mounted meter. Ionisation current and vacuum can be read off from calibration tables. The increasing importance of ultra high vacuum techniques, particularly in the semi-conductor industry, should make this instrument of interest. *Edwards High Vacuum Ltd., Wokingham, Royal, Crawley, Sussex.*

nylon bush fastener

CONSISTING of a moulded nylon bush, used in conjunction with a clamping screw, the "Insulgrip" fastener provides an insulated anchorage for sheet panel. To fix the device the nylon bush is inserted into a square hole cut in the sheet for the purpose, the bush having an undercut square shoulder to prevent rotation. The screw is driven into the bush and tightened. The effect is to compress and expand the inserted end of the bush which is locked firmly to the panel. A particular advantage of this fixing method

is that access to the back of the panel is not necessary. A range of sizes is available for these fasteners, the largest being for a 0.398 in. sq. hole, for which the pull-out force is 900 lb. An alternative type is more heavily insulated and designed for round-hole fixing. Besides its obvious applications in light engineering, the device should be particularly useful in the manufacture of electrical instruments and appliances. *George Goodman Ltd., Robin Hood La, Hall Green, Birmingham, 28.*

Aluminium busbar trunking

RECENTLY introduced is an aluminium busbar-trunking system for industrial installations. The trunking, fabricated in zinc-coated steel, is 7½ in. high by 3½ in. deep and is supplied in 8 ft lengths. The four 2 in. by ½ in. extruded aluminium alloy busbars are supported at 1 ft intervals, tap-off points being at every 2 ft. Standard tap-off boxes available are for 60 A and incorporate h.b.c. fuses and neutral link which plug directly into the busbars. A special interlock prevents accidental interchanging of the neutral with a fuse link. Entry units consisting of gland and cable sealing box, allow for connection direct to the busbars or via a 400 A TP and N isolator. Jointing of busbar lengths is carried out by means of bolted fishplates, contact surfaces having first been coated with a special compound supplied. For lengths of trunking greater than 100 ft there are expansion units. Known as the "Astralecon" system, advantage claimed by the makers is the saving possible in packing and transport

charges due to the compact design and light weight of the components. Basic price of the trunking is £1 6s 9d/ft run. *Astral Switchgear Ltd., Alma Rd, Enfield, Middlesex.*

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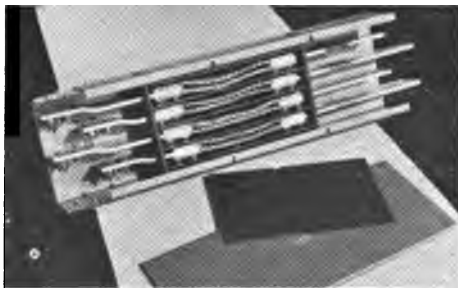
Stabilised power supply

CONSTRUCTED as a chassis unit for convenient mounting with other equipment, a recently introduced stabilised power supply provides ± 300 V d.c. at 0 to 100 mA, and in addition, an unregulated 6 A supply at 6.3 V a.c.

Output impedance of this unit is said to be less than 1 ohm, and the ripple to be less than 2 mV. The stabilising unit is 11½ in. by 9½ in. by 5½ in., high and connections may be made, either by a 6-pin socket on top of the chassis or from solder lugs underneath. *Servomex Controls, Crowborough, Sussex.*

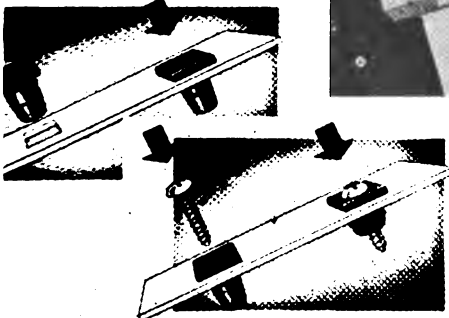
Portable test-meter range

A RANGE of versatile portable instruments for a.c. measurement of current and voltage has recently been introduced into this country from America. This is the "Amprobe" range of which there are a number of models having various ranges, including, for one model, resistance measurement. They are lightweight and compact and can be held easily in the hand by means of a pistol grip. The "clip-on" principle is used for current measurement, trigger operated jaws being snapped round one current-carrying conductor of the circuit to be tested. Voltage measurement is by means of test-prods. A typical model, the RS-1, has five current ranges covering 0 to 100 A while the two voltage ranges are 0 to 150 V and 0 to 600 V. The ranges of these instruments can be further extended by means of two transformer devices. One of these is in the form of a plug-adaptor which enables current readings to be taken from twin-conductor supply leads without having to break the conductor. A useful feature of the standard instrument is the scale-pointer locking device which enables readings to be taken in cramped situations. A range of test kits are available containing various combinations of the equipment described. These should prove invaluable to service engineers. *H. J. Baldwin and Co. Ltd., 221 Grand Bldgs, Trafalgar Sq, W.C.2.*



◀ Rigid, insulated fixing to sheet metals is ensured by the "Insulgrip". Driving a screw into the insulated nylon bush causes it to expand and grip the metal mounting plate.

▶ A feature of the "Amprobe" is the pointer locking device. In addition to 5 current ranges covering 0-100 A, voltage ranges may be measured with the equipment illustrated.



Relay with mechanical time delay

TWO relays recently announced incorporate an escapement movement to give a time delay either on opening or closing. Both relays are suitable for either a.c. or d.c. supplies and have consumptions of 25 VA on a.c. and 8 W on d.c. Micro-switches provide the auxiliary contacts, which are of the changeover type, having capacities varying from 10 A, 120 V a.c. to 5 A, 250 V a.c. or 0.1 A, 250 V d.c. These timer relays are claimed to have a repetitive accuracy of 1% and adjustment is provided over the complete timing range by a simple dial. Type R103 is available with three timing ranges of 0 to 10, 0 to 60 and 0 to 300 sec, while type R107 has a range of 0 to 600 sec. Weights of the relays are 1½ lb and 3½ lb, respectively, and certain intermediate timing ranges can be supplied if required. *Magnetic Controls Ltd., Maidstone, Kent.*

Epoxide resin price reduction

FROM 1 Oct. prices of all liquid and solid "Epophen" Epoxide Resins were reduced by 1s/pound. Similar reductions have been made on the "Epophen" hardeners. These resins are said to have wide applications in the electrical industry for potting and encapsulation. *Leicester, Lovell and Co. Ltd., North Baddesley, Southampton.*

Improved lifting magnet

BY using modern materials and construction techniques it is claimed that improved performance is obtained with a reduction in price for a new series of lifting magnets. The magnets are in the Burnand Phoenix range and have an "integral" design, the main feature of which is: use of a single high permeability steel casting in place of the separate top and rolled steel outer ring used in earlier designs. Advantages of

the new construction is reduction in the amount of machining required with consequent economies. Performance is also assisted by using improved winding insulation, although the vacuum drying and solid impregnation treatment which has been proved over many years will continue to be applied to the new designs. *W. E. Burnand and Sons Ltd., Duo Wks, 66-106 Shoreham St, Sheffield 1.*

Size reduction of silicon diode

A REDUCTION in the size of their 1A silicon junction rectifier has been achieved by AEI Electronic Apparatus Division which makes it more suitable for use in printed circuits. The type SJ Form 'F' silicon rectifier has a flange diameter of 13/32 in. and is intended to replace the Form 'B', whose rating is identical. *AEI Valve and Semiconductor Sales, Carholme Rd, Lincoln.*

GRID FAULT LOCATION

THE problem of locating faults on grid lines is particularly severe in Scotland where harsh winters combine with uneven terrain to make "walking the line" a difficult and time-consuming operation. In the *ELECTRICAL TIMES* for 3 September, 1959, a description was given of a fault locator operating on the radar pulse principle which had been developed by Ferranti, Edinburgh. The locator was of the d.c. type, requiring connection to the line and, therefore, only suitable for "dead-line" working.

Promise of devising an a.c. locator suitable for "live-line" working, made at that time, has now been fulfilled, and the instrument was demonstrated last week to area board engineers and consultants. Facilities for the demonstration were made available by the SSEB at their Clydes' Mill power station.

The a.c. detector has been developed for use on 132 or 275 kV lines but is said to be suitable for lower or higher system voltages. It is claimed to detect position of arcing faults, ice build-up and conductor oscillations to an accuracy of 1% of the line length or 1,000 yards, whichever is the greater.

The instrument has been designed for simple operation in either manned or unmanned substations and, by making use of the station battery supply, it is rendered independent of errors due to mains voltage fluctuations.

Range of the instrument is said to be from one mile to a maximum of 100 miles, depending on line conditions. The signals are injected into the line through some coupling device which may well be the coupling capacitor of a carrier control system.

The transmitted signal consists of a series of 5 micro-second pulses with a peak-to-peak amplitude of 400 V and at a mean frequency of 1 Mc/s. The injected pulses are spaced at approximately 5 millisecond intervals. All discontinuities on the line cause reflections and it is by measuring the time interval between the transmitted pulse and the received reflection that the distance to a fault is estimated. Reflections are obtained not only from a fault

position but also from permanent features such as towers, so that some care in interpreting results is necessary.

An important advantage of the a.c. locator is that, by using it in conjunction with a camera, records can be obtained of transient faults. A Shackman Autocamera is used which automatically resets after taking a photograph so that several faults may be recorded in succession without developing the film. For a transient fault the recording must be obtained between the operation of the first fault relay and opening of the circuit-breaker, an interval usually of the order of 150 milliseconds. After an initial delay of 20 milliseconds to allow transients to subside, the camera photographs the display cathode ray trace, also in about 20 milliseconds. A viewing facility for monitoring and inspection is also provided, and to enable the operator to examine a line in greater detail provision is made for scanning any 15-mile section of the line throughout its length. The display used gives a picture of the permanent features of the line which provides range calibration.



Mr C. L. C. Allan, chief engineer, NSHEB (second from left), and Mr C. Walters, chief technical officer of the SSEB (right), discuss with Ferranti representatives operation of a prototype instrument for locating faults on live h.v. transmission lines. Using a pulse reflection principle, the instrument is claimed to locate arcing faults, conductor swinging or ice build-up to within 1% of the line length

PROBLEMS AND PRACTICE

of Starter Faults

Following two cases illustrate a fault on a motor starter causing serious inconvenience and damage to other parts of an installation.

In a certain factory installation, 18 h.p., 10 h.p., 5 h.p. motors, each controlled by a star-delta starter with overload and lockout releases. The motors were fed through a distribution box, B, by a combined main switch, C. Naturally, the other two motors could not be started. Although the individual motor fuses in distribution box, F, were intact, one rotor starting resistance for the 40 h.p. slip-ring motor had also failed.

The occurrence stressed the importance of regular maintenance and inspection of starters and ancillary gear as well as the correct grading of fuses in main and sub-distribution boards. It also illustrated the danger of allowing a motor to remain stalled with current switched on. In this case the 25 h.p. motor could not be seen from the starter position and the operator had no means of knowing whether or not the motor was running. An ammeter was installed by the starter and the operator instructed to hold the handle in the starting position until the ammeter needle indicated that the current had fallen to a steady value before moving over to the running position. He was also warned to switch off if the current did not quickly settle down to the full-load value.

The incident would not, of course, have occurred had the starter been of the "free-handle" type with overload protection.—J. L. Watts.

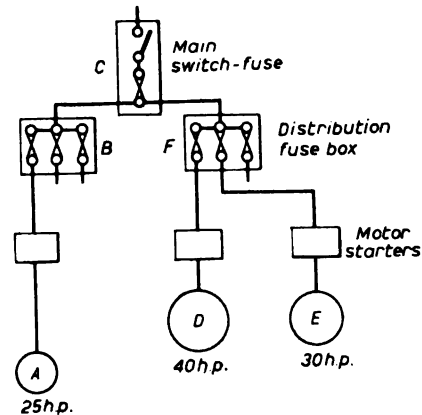
...ly, an arc was first drawn out of the fixed and moving contacts and transferred from the fixed to the earthed cover as the contacts passed, under the influence of the controlling spring and momentum, beyond dead centre. The voltage was enough to momentarily cause a voltage sufficient to cause a dangerous operation of the under-ones on the other starters and the arc without blowing the fuses. The remedy was to fit arc chutes so that the moving contact remained enshrouded, even on beyond dead centre.

In another case concerned an installation in which a 25 h.p. conveyor motor, controlled by a star-delta starter, was controlled by a switch-fuse in a distribution box. On one occasion the motor was started. What is more, nor the 40 h.p. motor, D, and 30 h.p. motor, E, which were fed through a distribution box, F, in which

all fuses were intact. Examination disclosed badly burned contacts in the 25 h.p. starter, so bad in fact that single phasing occurred in both starting and running positions. It seemed evident that the starter must have been running in the single-phase condition for some time since the cables between the starter and motor were overheated and had an earth fault, necessitating renewal. As a result, one of the heavier rated fuses in distribution box, B, had gone together with one in main switch, C. Naturally, the other two motors could not be started. Although the individual motor fuses in distribution box, F, were intact, one rotor starting resistance for the 40 h.p. slip-ring motor had also failed.

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A fault on the 25 h.p. motor A was responsible for fuses in C blowing, thereby affecting motors D and E. For clarity the diagram is shown in single line; fuses and cables are, of course, 3-phase

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Tungsten Ballasts

"It makes me wonder," says Mr Ralph (page 453, 22 Sept.), "why the tungsten filament ballast should ever have been considered a commercial proposition." The simple answer is, of course, that it is. Not, one hastens to add, where a purely fluorescent installation would be satisfactory, but in those cases—shop lighting immediately springs to mind—where a combination of fluorescent and tungsten filament is ideal. Whenever one-third or a higher proportion of the total light is required from filament lamps, the filament lamp ballast is likely to give a cheaper and lighter installation with similar consumption. Take a hypothetical case. Suppose we require about 100,000 lumens from de-luxe fluorescent tubes and the same amount from tungsten filament lighting. The outputs and consumptions of two possible systems would be:

Scheme A.	30- 80 W tubes	96,000 lm.	2.4 kW
	30 ballasts		0.45 kW
	90-100 W spots	97,200 lm.	9.00 kW
	TOTAL	193,200 lm.	11.85 kW
Scheme B.	65- 40 W tubes	96,200 lm.	2.6 kW
	65- 75 W lamps	48,295 lm.	4.87 kW
	46-100 W spots	49,680 lm.	4.6 kW
	TOTAL	194,175 lm.	12.07 kW

In fact, being realistic about the accuracy to which we know the quantities involved, we can say that the outputs and consumptions are the same.

Of course, tube life is shorter, though the reverse is true of the ballast lamps, and in particular instances there may be good reasons for using only inductive ballasts. What can be said, however, is that there is often a good case for using all or part of the filament side of a mixed installation to control all or part of the fluorescent.—J. Boud.

Mr McNeill Replies

May I reply to Mr Boud? With regard to the two schemes compared, it is interesting to note that in both cases the tungsten filament lamp watts are more than three times that of the fluorescent lighting. This tends to swamp the relative efficiency factors of the fluorescent lighting sections alone. It should also be noted that the ballast lamp circuit is normally limited to use with 4 ft 40 W tubes, whereas 5 ft 80 W and 8 ft 125 W tubes are almost invariably more suitable for high level lighting in modern store interiors.

The most important factor appears to

be in deciding the proportion of filament lighting required to supplement the general fluorescent lighting. In the case of fluorescent tube plus ballast lamp, a 75 W ballast lamp must be used with every 4 ft 40 W tube, so taking nearly twice as much filament lamp watts as fluorescent. In practice, it is often desirable to vary the proportion of filament to fluorescent lighting in different parts of a store interior since, in certain locations—such as over jewellery displays—an all-filament lamp scheme may be preferable, while in other general display areas an all-fluorescent installation may be adequate.

In the average location, however, it is normally desirable to supplement the general fluorescent lighting with a few tungsten filament spotlights to give a varied and more interesting brightness pattern and to accentuate specific display features. For this type of display area the use of one 50 W low voltage spotlight per twin 5 ft 80 W fluorescent tube fitting will normally give a reasonable balance. It is also found that the concentrated beam provided by low voltage filament lamp spotlights is ideally suited for high-lighting individual display features with the minimum of spill, so creating a more dramatic effect against the lower illuminated background.

A further factor which has reduced the need for a high proportion of supplementary lighting has been the development of fluorescent tubes in which the red colour rendering is at least equal to that of filament lamps.

Provided, therefore, that fluorescent tubes with good all round colour rendering properties, such as de-luxe Natural, are used, a scheme comprising 32-50 W, 12 V spotlights, in conjunction with 32 twin tube 5 ft 80 W louvred store lighting fittings will provide a total light output of 194,400 lumens with colour rendering quality and accent lighting adequate for store applications.

The kilowatt loading and costs associated with this arrangement (scheme C) are detailed in the following table, together with schemes A and B in Mr Boud's letter for comparison, allowing for comparable twin tube louvred store lighting fittings and narrow beam spotlights in each case and taking the cost of electricity as 1½d per unit.

Scheme	A	B	C
kW load	11.85	12.075	7.84
Initial Cost	£684	£528	£881
Running Cost	£222	£226	£147
Current	£116	£91	£67
Replacements			

Comparing the ballast lamp scheme B with scheme C, it will be seen that the difference in initial cost of fittings amounts to £353, whereas the cost of current consumed in the two schemes over a period of 3,000 hrs, that is, one year of normal average use, shows a difference of £79 per annum in favour of C. This scheme also shows a further saving of £24 per annum on lamp and tube replacement costs. Assuming an

average fitting life of ten years, the extra cost of electricity and lamp replacements in scheme B is about £1,030 than for scheme C, nearly three times the difference in initial cost of £: G. V. McNeill.

[Mr Boud and Mr McNeill make points with admirable clarity. The rhetorical case rarely corresponds to practical one however and each illumination has to be planned to meet requirements of the situation. It is a compromise between the ideal initial cost, running cost and lighting effect. It is for the user to decide in which respect he is best able to make a sacrifice. To some, capital outlay is of more importance than running costs, to others, it is the reverse. In the case, lighting effect is all important to blazes with initial and running costs. The task of the lighting engineer is to strike the most acceptable balance between all three and this he does with consistent success, often depending on his experience rather than on the coefficients and factors which feature in illumination textbooks. These coefficients are enriched by such discussion and would like to see more of them.]

Control Circuit Query

IN regard to Mr F. d'Abila's letter on control circuit protection, in Sept. issue, would not the insertion of a suitable resistance in the c.h.t. to limit any fault current obviate the necessity of the protective circuit suggested?—W. Thompson.

Floodlighting effects at Little Barford "B"

TO the casual observer, the most impressive feature of Little Barford "B" generating station is the pair of external boiler structures which, at night, have the appearance of being floodlit.

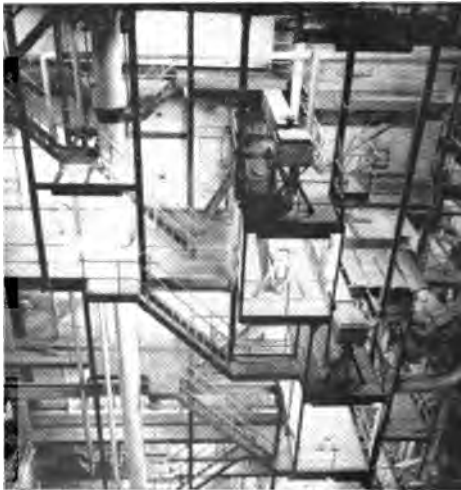
Actually, floodlighting fittings have not been used. The normal night-time lighting for engineers and staff has been so arranged that none of the light from the 5 ft 80 W weather-resistant fluorescent lighting fittings falls outwards from the structure, excepting only in one or two places where not to have done so would have introduced hazardous conditions. Over 100 fittings are installed in these areas.

In the turbine hall, 16 1-kW h.p.m. fluorescent lamps in reflector fittings mounted high in the roof provide an overall illumination of 10 lumens/sq ft on the operating floor. In the basement, tubular fluorescent lighting gives additional illumination.

Fluorescent lighting above an "Ionlite Series 1" suspended illuminated ceiling provides the normal light in the control room. For emergencies, four recessed decorative tungsten fittings have been incorporated.

All of the lighting units were supplied from their standard range by Falks, whose engineers worked in close collaboration with the architects, electrical and illuminating engineers and officers and staff of the Board throughout.

General view of the outdoor boiler structure at Little Barford "B" power station with, below, the distant floodlight effect achieved



News of the Week

JOHN THOMPSON TO MAKE COOKERS

Link with U.S. Concern

JOHN THOMPSON (WOLVERHAMPTON) LTD., the boiler-making and heavy engineering group, is moving into the domestic appliance field. It is understood that an agreement has been concluded between a subsidiary, John Thompson Instrument Co., and the Tappan Company of Mansfield, Ohio, under which electric cookers of the Tappan series will be produced at Wolverhampton.

Details of the project will be revealed at a meeting in London on 25 Oct., but it is believed that the cookers, which are in the luxury class, will be marketed in the UK under the name "Thompson-Tappan." In America the Tappan Co. produce various types of ranges—electric, gas and electronic—in free-standing and built-in styles, with all the latest gadgets, including broilers and eye-level control panels.

Earlier this month, John Thompson announced their intention to extend their industrial refrigeration manufacturing activities from South Africa to the UK. Domestic refrigerators and retailing equipment were specifically excluded in the announcement of that plan.

Radio Rentals buy "Baird"

"BAIRD," name of the inventor of television will, in future, be the brand name of Radio Rentals Ltd.'s television and radio sets. Announcing this last week, Mr P. Perring-Thoms, founder and chairman, said his company had purchased Baird Television Ltd. Acquisition of the "Baird" name appears to have been an important factor in negotiations. Price of the deal was not disclosed. Hitherto, sets rented by Radio Rentals have borne the symbol "RR" and those sold outright "MRG," standing for Mains Radio Gramophones, the subsidiary which manufactures both radio and television receivers at Bradford. In the past six months, Radio Rentals has been selling its products to the trade as well as direct to the public through its own nation-wide organisation.

Mr Perring-Thoms is now in Australia visiting a "rent or buy" subsidiary there. He left by air, via the US, immediately following the announcement of the Baird deal.

Transmission group move

THE Transmission Project Group of the CEGB, under Mr H. R. Schofield, will move from London to Stockland Hse, Portsmouth Rd, Guildford, early in the new year. The Board have taken a 99-year lease of the premises, we understand.

VACTRIC STOPS WASHING MACHINE PRODUCTION

FIRST announcement by the newly appointed receiver and manager of Vactric Ltd., Mr J. W. Margetts, is the suspension of production by the washing machine subsidiary, Vactric (Manufacturing), which is being put into creditors' voluntary liquidation.

However, Vactric may get a bid from Longford Electric Co. of Manchester. Longford is understood to be seeking additional factory premises to meet increasing demand for its spin-dry washing machines.

£1½ m. cable contract

THE Renfrew factory of Scottish Cables Ltd., a member of the BICC Group, has just obtained its biggest contract. The order is for £1½ million worth of paper- and plastics-insulated underground cables to be supplied in 1961 to the South of Scotland Electricity Board for the distribution of electricity.

NEW FACTORY PLANS

For Associated Transistors . . .

A NEW factory for Associated Transistors Ltd. is to be erected on an 18-acre site recently acquired at Basingstoke. The first phase of construction will cover 120,000 sq ft and building work started last week. Planning of the second phase is well advanced. By 1963, annual output should be about 15 million transistors. Initially, there will be about 1,000 employees. Associated Transistors was formed in 1958 jointly by Automatic Telephone and Electric Co., English Electric Co. and Ericsson Telephones Ltd.

. . . Belling's extension

A NEW extension of Belling and Co. Ltd., at Enfield, now nearing completion, and a further extension there on which work is soon to start, will provide another 100,000 sq ft of productive space. At Burnley, a further 100,000 sq ft of capacity should be in use early

Boards' appliance sales

STEADY improvement in washing-machine sales is one feature of the latest return of domestic-appliance sales by electricity boards in England and Wales. The total of such sales in August—7,780—was just over 700 more than in the previous month and nearly 1,000 more than in June. Sales of cookers, also, have been well maintained but refrigera-

Appliances Sales by Area Boards	Sales in month ended 31 Aug., 1960		Sales in 12 months ended 31 Aug., 1960	
	Total	% change over Aug. 1959	Total	% change over previous 12 months
Cookers ...	26,429	+ 1.3	339,121	+ 3.2
Water Heaters:				
Immersion	16,642	- 9.1	190,546	+ 1.5
Storage ...	5,176	+ 17.6	67,571	+ 17.0
Washboilers	4,537	- 19.7	59,880	- 18.0
Washing Machines...	7,780	- 42.3	133,797	- 17.2
Refrigerators	9,154	- 48.5	146,805	- 6.5

tors sagged off badly in the poor weather of August, reaching only 9,154, the lowest month's figure since last February. That total compares with 16,425 in July and 29,833 in the month of June last.

When assessing the figures given above it must be borne in mind that the sales by area boards represent only a part of the total sales throughout the country.

. . . and for Plessey

PLANS for another factory in Hampshire, near Titchfield, on the London-Southampton road, are being prepared by the Plessey Co. That firm is finalising negotiations for the purchase of the old 66-acre RAF balloon barrage station, Southampton, where it is proposed to manufacture components for a wide range of industries, with an initial labour force of over 600. Because the site is not zoned for industrial purposes the application for planning has to be referred to the Ministry of Housing and Local Government, but it is hoped to start production before the end of 1961.



Although believed to be the largest load yet to travel on the M1 motorway, this 125-ton transformer broke no speed records on its journey from the AEI Rugby Works to the CEB Midlands Division substation at Feckenham, Worcs. The 94-mile journey took approximately three days. The 120 MVA transformer is the first of two being supplied to Feckenham

Skilled Labour Still Short

DESPITE the credit squeeze, shortage of skilled labour was still expected by industrialists, a fortnight ago, to be the greatest limitation to production in the next four months. When the Federation of British Industries quizzed 728 manufacturers at the end of September, 30% thought skilled labour shortages would be the main curb on their output, while shortage of orders or sales was next in importance with 22%.

The survey showed a shading off in optimism about the general business situation, but expectations of capital expenditure in the next 12 months did not alter radically. Building expenditure was expected to decline by a greater proportion of industrialists than at the last survey, but plant and machinery showed an opposite trend. Excluding seasonal factors, 57% said they were working at full capacity.

Rising output was indicated by 40% of those questioned, against 10% who said it was falling, but 37% said profit margins per unit had fallen, with costs showing an upward trend.

More trouble at Hunterston

ONCE again labour difficulties have arisen on work of building the Hunterston nuclear power station for the South of Scotland Electricity Board, and once again the welders are involved. On Thursday last, 260 welders working there gave seven days' notice of termination of their employment. This followed the employers'—the Motherwell Bridge and Engineering Co.—refusal to reinstate nine welders who were dismissed on 7 Oct. Then, the other welders claimed they had been wrongfully dismissed and demanded their reinstatement. Talks between representatives of the Boilermakers' Society and the firm ended in deadlock last week and the 260 welders handed in their notices.

According to the West of Scotland delegate to the Boilermakers' Society, the nine welders were told to do certain work begun by other welders whose work had been declared below the required standard. The nine men wanted an assurance that they would not be held responsible for any faults which were there before they took over the job. This assurance was refused, he maintained, so they would not undertake the work and were dismissed.

It will be recalled that the Motherwell Bridge and Engineering Co., who are responsible for the main constructional work at the station, suspended work on their contract for 15 weeks between

Sept., 1959, and Jan., 1960, and dismissed 500 men on the site because of recurring strikes. Work restarted in January after a new wages structure had been approved by the unions involved—the welders being the last group to accept it.

Fire Precautions for Factories

FIRE alarms will be required in about 10,000 more factories than at present when some provisions of the Factories Act, 1959, comes into force next December. The statutory instrument naming 1 Dec., 1960, as the day was published last week. Also brought into effect then will be detailed fire protection requirements of the Act, affecting provision of fire-fighting equipment. Under the new provisions, fire brigade officers will be associated with factory inspectors in checking on the fire precautions in factories. The Chief Inspector of Factories has stated his intention of sending a letter to all factory occupiers, drawing their attention to the new requirements and advising them in particular on fire-fighting equipment and alarms.

Radio remains popular

SOUND radio is not waning in popularity, latest figures of the Radio and Television Retailers' Association show. While television sales have fallen sharply in the face of hire-purchase restrictions, radio sales have actually moved ahead. Average sales of 16 radio sets per shop during August compares with 15 a year earlier; comparable figures for television show a drop from eight to 5.5 sets per shop. But the lower price of radio makes it less vulnerable to hire-purchase curbs. While the percentage of television sets sold on hire-purchase dropped from 58.2% in August, 1959, to 45.6% in August this year, the fall was only from 40.4% to 34.3% in the case of radio.

Television sales rose by 1.5 sets per shop from July to August this year but failed to match the seasonal upturn usually evident in that month.

Supply for Borrowdale

THE plan to supply electricity to hamlets and dwellings at the head of the Borrowdale Valley is now being finalised, it was stated at the recent meeting of the Lake District Planning Board. The North Western Electricity Board have offered to lay the line to Borrowdale underground where there is no tree cover and the supply to Seathwaite will be taken by means of a p.v.c. cable from Seatoller through Low Stile Wood. Supply to Stonethwaite will be by a normal type of o.h. line sited on the fell side in a position to be approved by the planning board and the National Parks Commission. But the latter two concerns want that section also placed underground.

OFFICIAL PUBLICATIONS

NJAC for Electricity Supply Industry 1959-60 Report (see page 604).

Advisory Committee on Examination of Steam Boilers in Industry. HMSO. 1s 3d (see page 590).

Council for the Preservation of Rural England. Report for 1959-60. (see ELECTRICAL TIMES, 28 July, 1960).

Factories Act, 1959 (Commencement No. 4) Order, 1960. S.I. No. 1839. HMSO. 2d (see page 618).

Factories (Fire Certificate Application) Order, 1960. S.I. No. 1840. HMSO. 3d (see page 618).

ERA Publications:

D/T112. Intrinsically Safe Electrical Apparatus. Relation of Igniting Current to Circuit Inductance for a Mixture of Buta-1:3-diene with Air, P. B. Smith and N. L. Heathcote (4s 6d); D/T113. Intrinsically Safe Electrical Apparatus. Relation

of Igniting Current to Circuit Inductance for a Mixture of Carbon Disulphide Vapour with Air, P. B. Smith and N. L. Heathcote (6s); D/T114. Flameproof Enclosures: Effect of Internal Pressure on the Flange Gap Width at the Time of Ignition of an External Mixture, T. J. A. Brown and N. Simpson (15s); G/T312. Restriking Voltage 33 kV Survey—East Cornwall Network, J. S. Vosper (10s 6d); N/T86. Effect of Temperatures of 650°C and 700°C on the Magnetisation and Properties of Alcomax Magnets, A. G. Clegg and M. McCaig (4s 6d); S/T97. Line and Neutral Currents in Multi-Limb Transformers under Impulse-Test Conditions, E. L. White (15s).

Organisation of Electric Power Services in Europe (second edition). UN Report. 5s.

Two Bids For Elizabethan

TWO firms are interested in buying the washing machine manufacturing business at Bishop's Stortford of Elizabethan Engineering Co. Ltd. and its subsidiary, Elizabethan Dynamatic Ltd. (whose voluntary liquidation we referred to on 15 September). Both Elizabethan companies are in liquidation with a combined deficiency of about £241,000, including £50,000 paid capital. Assets total about £79,000. The takeover approaches were disclosed by Mr H. E. Hassell, joint liquidator, at a creditors' meeting in London on 12 October.

The value of the offers and the names of the bidders were not disclosed. Without this information, creditors were not in a position to decide on a proposal of the managing director of both the Elizabethan companies (Mr J. Morgan) that the Elizabethan enterprise should be carried on by the present directors under the surveillance of an Inspection Committee appointed by creditors. Creditors appointed the Inspection Committee, but decided to take no further action until they had been advised by the liquidators.

An important factor in creditors' deliberations is a contingent claim of £98,000 by hire purchase companies if

service facilities for Dynamatic washing machines should be discontinued. One of the potential purchasers has already stated that they would maintain service facilities if their bid were accepted.

Each of the three directors of Elizabethan Engineering, Messrs J. Morgan, J. Boniface and L. J. Foley, is involved in a personal guarantee against liabilities.

Refrigerator Production

DURING his tour of the Morphy-Richards' Dundee factories last week, Sir Joseph Lockwood, chairman of Electric and Musical Industries, which recently acquired control of the business, said they hoped to carry out further extensions at the Astral subsidiary. Later, Mr W. Roxburgh, managing director of Morphy-Richards (Astral) Ltd., intimated that they were planning to transfer the whole of the refrigerator production to the new factory being built at West Kingway and to introduce new products to the Longtown factory, which would probably raise the number of employees from 1,250 to about 1,500.

B.S.R. Cut Production

ABOUT 980 employees are likely to be made redundant at the Londonderry works of Birmingham Sound Reproducers Ltd. as the result of the company's decision to cut production. Dr D. M. McDonald, chairman, last week stated that this step was due to the rising costs in Northern Ireland, not least among which are the freight rates to British ports. He emphasised that the export business to the United States had become increasingly competitive and the company did not intend to lose any of it. Emphasising the value of such business, he said the export value of sales in the US during 1959 was nearly \$1 million greater than the sale of all British bicycles to the US in that year.

Another Dishwasher

YET another domestic dishwashing machine is about to be launched on the market—this time an "electronic" model costing 60 gn. It has fully automatic push-button control and the firm, Halpins (Dishtron) Ltd., 57-61 London Rd, Southampton, claim that it will deal with a complete dinner service and dishes, including rinsing and drying. Expected to be available within three months the machine will probably be supplied direct to retailers, we understand.

STUDY ON STATIC

AN investigation of the cause of the generation of static electricity in synthetic fibres is being carried out at the British Cotton Industry Research Association headquarters at Shirley Institute, Manchester. This was announced by Dr D. W. Hill, director of the Institute, at the annual meeting of the Association last Thursday.

Retail Sales Steady

RETAIL sales were maintained in September at about the same level as during the past six months, allowing for seasonal differences, according to an estimate by the Board of Trade. Compared with a year earlier, sales in September were up by 2% to 3% in volume after adjusting for a 1% rise in prices during the year. The Board of Trade says there are indications that clothing and footwear sales were very buoyant last month, but durable goods probably failed to show any rise.

Switchgear for Kuwait

AN order for switchgear valued at £156,000 has been placed with South Wales Switchgear Ltd. by the Government of Kuwait. The contract is for 500 MVA 11 kV type switchgear for three main substations. For each of two substations at Hawalli and Naif Gate, the equipment includes a 21-panel duplicate-busbar air-insulated switchboard, incorporating solenoid-operated circuit-breakers of up to 1,600 A ratings.

The third substation—at Kuwait Airport—will have the same equipment on a smaller scale.

Civils and Municipals to amalgamate

AMALGAMATION of the Institution of Civil Engineers and the Institution of Municipal Engineers is proposed. Terms of the amalgamation have been agreed by both Councils and are now being circulated to the 17,000 corporate members of the Civils and the 6,000 members of the Municipals, who are asked to decide. The latter Institution (which was formed in 1873) will be absorbed in the Civils (formed in 1818) and become a special branch therein.

Outlining the principles of the plan, Sir Herbert Manzoni, president of the

Civils, reveals that during the past four years the Council of the Institution have had under constant review the reunification of the profession which has suffered much from "fragmentation" or "splinter" groups in the past and new organisations of specialist groups are continually being formed. The ICE Council believes that engineering is one profession which covers all the specialist branches. "The ultimate aim should be that of one society of professional engineers whose corporate members should be chartered engineers," he adds.

Lord Glentoran, Minister of Commerce for N. Ireland, recently visited the Dummurly factory of Wandleside Warren Wire Co. He was escorted round by the managing director, W. L. Wray (seen on right). Also seen are the Minister's private secretary, Mr A. McCullough, and the factory manager, Mr R. M. Gibson



Automatic Shunting on District Line

AS part of modernisation of signalling and shunting on the Earls Court/Putney Bridge section of the District Line, London Transport is now installing electrically operated "programme machines" at Putney Bridge Station to control signals and junctions automatically. First stage of the project was completed earlier this month, when a battery of programme machines went into action at Parsons Green. The new machines are an improved version of machines installed two years ago on the Northern Line and at Watford. For the first time, trains are identified by their numbers, which are punched into the programme rolls used in the machines.

An additional innovation was required at Parsons Green to permit flexibility in the programme on the rolls. At Parsons Green, shunting is complicated by the ten sidings being located on either side of the two main tracks and at both ends of the station; this means that trains going

to sidings sometimes move on the main tracks. Without some flexibility, chaos might result if a siding train arrived late or early. The programme machine would still set the points in the order in which trains should have arrived. The problem has been overcome by introducing an additional programme machine, making four in the battery. By a highly complicated process, this machine is automatically scanned by No. 3, which in turn reacts upon the others to produce the right switching for the siding train, out of turn.

In an emergency, trains may be switched by push-button from a new supervision room at Earls Court.

Supervision of Industry Needed—Citrine

WITH the big, privately owned organisations approaching complete monopoly there must be some stimulus to public supervision and even public ownership, Lord Citrine said at Newton Abbot last week, when he delivered the George Johnstone lecture. In groping for a solution to the problem, Lord Citrine said his feeling was that something in line with the Iron and Steel Board type of organisation might be a solution.

The George Johnstone lecture is sponsored annually by the SW Electricity Board and the Seale Hayne Agricultural College, Newton Abbot.

Welding Standardisation

THE first conference on welding standardisation is to be held by the Institute of Welding on 7 Dec. at 54 Prince's Gate, S.W.7. The theme will be the role of welding standardisation in production and export, among the subjects for discussion being the specifications for steels, and standards for welded structure. The conference is open to individual corporate members and nominees of industrial corporate members.

No Complaints About Estimated Accounts

IT was too early to say whether the experiment with estimated accounts in Surrey Suburban District last quarter had been successful, but no complaints had been received so far, last week's meeting of the London Electricity Consultative Council was told. Opinion of the Council was divided on the proposal for estimated accounts, aimed at cutting costs by reducing the number of readings from four to three each year. However, the meeting made no recommendations to the LEB about the plan.

Turning to publicity, the Council decided to ask the Electrical Development Association to find a name for the "little boy" symbol which has been used on electricity posters and pamphlets in recent years. "Willie Watt" was mentioned as a possibility by Sir Laurence Watkinson, who was in the chair for the first time.

CONVENTIO

Refrigeration . . .

A TECHNICAL convention simultaneously with the se national Refrigeration and A ing Exhibition in London. The programme is now bei by a committee of specialist chairmanship of Dr J. C. Fi chairman of the technical b International Institute of R

. . . S.I.M.A.

PRODUCTIVITY will be theme at the ninth conven Scientific Instrument M: Association, to be held at from 17 to 20 Nov. Four qualified speakers will cover of the subject—design, r floor production and sales. speakers will be Mr A. H. technical manager, GEC O Division; Mr C. H. Starr, ch AEI Central Engineering S Mr R. H. S. Lesser (Philij Panel under the chairman: D. A. Pitman of Electronic Ltd. will have Mr R. J. operational research manag Siddeley Industries Ltd., Mr of Marconi Wireless Telegra two other speakers.

. . . and Semico

FOR the International Syn Semiconductor Devices to Paris from 20-25 Feb. next, ing committee have exte 30 Nov., the date by which are to send a summary of t The entire text of the pape submitted by 31 Dec. next.

ROYAL OPENING FOR KINCARDINE

CONGRATULATIONS on the station design and facilities for employees' welfare were offered by the Queen when Her Majesty officially opened the Kincardine-on-Forth 760 MW generating station of the SSEB on Wednesday of last week. A large audience had assembled in the station canteen to witness the unveiling by Her Majesty of a commemorative plaque.

On arrival at the station and the Duke of Edinburgh presented to Mr J. A. Little, Q chairman of the SSEB, Sir J. After the ceremony Her M conducted round the stati superintendent, Mr G. Nicl the Duke was accompanied l Henderson, chief engineer of

In welcoming the Queen Pickles referred to the im Kincardine for meeting ti electricity demands in Scotlar tioned that ash from the help to reclaim agricultural the Forth of more than twice occupied by the station.

After leaving the station and the Duke visited one of new houses occupied by a fitter, Mr Marr, and his w houses built by the Board an with floor-warming installati station has itself an off-peak ing load of 864 kW. Other the station were described in TIMES for 13 Oct.



First of six 110 MVA transformers being supplied by English Electric Co. arriving at Hinkley Point nuclear power station

Hinton on Radiation Safety

IN normal operation of nuclear power stations, the only hazards of radio-activity were those arising from gamma activity and neutron activity, suggested Sir Christopher Hinton in a paper before the TUC conference on radiation in industry last week. The plant could be designed so that operators were protected from these and other sources of radiation under normal operation, he said. There was always the possibility of abnormal conditions, as when a fuel can fractures while being removed from the reactor. Then the plant would have to be cleaned. This risk must be understood by the employee and accepted as a reasonable one, where every wise precaution has been taken to keep it under control. Each employee must feel that he can escape from the risk by the exercise of physical or mental skill. To this end, proper training was required.

G.E.C. Gets Traction Order

GENERAL Electric Co. has started work on a £580,000 order from the BTC for the electrical equipment for 23 trains capable of 90 m.p.h. The trains, of which 15 are four-car and eight two-car types, will run between Liverpool St and Clacton or Walton.

SAVING LONDON'S FEET

WE are informed by Alliance Electrical Co. that they were responsible for the relatively large and unusual electrical installation work connected with the Travolator at Southern Railway Bank Station (ELECTRICAL TIMES, 6 Oct.), including the lighting of the Travolator itself and associated lighting work in the platform, booking hall and subways. They were also concerned with the final design of the lighting fittings.

Sayings OF THE WEEK

"At one time company directors used to turn to the obituaries column in 'The Times' to find out whether they were alive or dead. Nowadays they turn to the City page, after they have been away, to find out which company they are working for." . . . MR W. J. BIRD, of GEC, at the Electrical Engineers' Exhibition dinner.

"A year's subscription to 'Which?' certainly saved me money, but it converted me from a happy spendthrift into a suspicious misanthrope." . . . MARK BOURNE, writing to The Guardian.

"The coal comes in roughly in the middle and is so dealt with that all the electricity comes out at the west, and all the smoke, ash and other waste comes out at the east." . . . PATRICK NUTTGENS, writing on the Kincardine power station in The Scotsman.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, October 18

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	222½	-4	ZINC, virgin, min. 98% purity (cash) ...	87½	-½
" (3 months) ...	224	-4	" (3 months) ...	86½	-½
LEAD, refined pig. 99.97% purity (cash) ...	67½	+½	RUBBER, per lb No. 1, RSS, spot ...	29d	+½d
" (3 months) ...	68½	+½	c.i.f. basis, ports. Dec. ...	27½d	-½d
TIN, refined, min. 99.75% purity (settlement) ...	809	-2	ARMOURING: Galv. Steel Wire (0.104 in.) ...	66½	—
" (3 months) ...	798	-3½	Mild Steel Tape (0.04 x 1½ in.) ...	53½	—
ALUMINIUM, ingots 99.995% (3 months) ...	186	—	NICKEL (home) ...	600	—
wire bars (4 x 4 x 54") ...	193½	—	MERCURY (76 lb flask) ...	70	—
BRASS Strip 63/37 ...	200½	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	-1c
SILVER (Troy oz) ...	79½d	—	Lead, (New York) ...	12c	—

* Tape Price, now on average, includes varnishing

SEMICONDUCTOR LABORATORIES REORGANISED

SEVENTEEN months ago the completion of the second section of Mullard's Southampton semiconductor factory was reported in these pages (p. 730, 7 May, 1959). Since that date a further 30,000 sq ft of administration and factory space has been added, the canteen area has been doubled and the staff increased from 1,000 to over 2,000. Production, doubled from 1958 in 1959, looks like being redoubled in 1960 and a further 95,000 sq ft of floor area is under construction and scheduled for completion in March of next year

The expansion of the production and research activities has necessitated a reorganisation of the laboratory personnel into six separate project groups which, though interdependent in some respects, will each explore a different field of semiconductor application. Under the over-riding control of Mr E. Wolfendale, head of the laboratories, will be two main sections dealing with development assistance and device evaluation by the one and circuit development and consultant service by the other.

The former will be subdivided into electrical development (J. A. Ingham)

and device investigation (M. E. Cooke); the latter into power and industrial control (J. H. Tuley), telecommunications and general industrial (A. J. Rees), computers and industrial switching (A. F. Newall) and radio and television (L. E. Jansson).

L.E.B. at Willesden show

FOURTEEN manufacturers participated in the exhibition and continuous demonstration of cooking, water heating, clothes and dishwashing equipment in the marquee of the London Electricity Board at the annual Willesden show last month. A feature of this year's exhibition was the information stand in a garden setting, where a "Publicphone" system enabled anyone interested to dial a number on the telephone and obtain information, both from the Board and individual manufacturers, on electrical equipment.

News in Brief

Incidental music accompanied a short film of the manufacture of "Netabulbs" at the AEI works, which was shown on BBC TV programme "Tonight" last Friday.

In the electric-warming system for part of the Hanger La underpass, to which we referred on 29 Sept., a total of 144 "Ashatherm" cables, each of 613 ft, were used, we are now informed by Aerialite Ltd.

Annual dinner of the Midlands branch of the ETCTA will be held on 28 Oct. at the County Ground, Edgbaston. Tickets are obtainable from J. T. Aitken, 27 Hobart Dr, Walsall.

The EIBA has received a legacy of £100 from the estate of the late Mr H. F. Gill, of Purley, for many years honorary secretary of the Surrey and West Kent branch.

Midlothian County Council Finance Committee has agreed that the new Dalkeith secondary school shall be electrically heated.



This point of sale crown, in four colours, is now available for the Parkinson Cowan "Mayhurst" fan heater

Company Activities

GENERALLY rather dull with bright intervals, as the "met" office might say. Despite a certain amount of buoyancy from optimists hoping for an early easing of the squeeze, markets got off to a hesitant start. BMC's mid-week announcement of extensive short-time working, coupled with similar news from Rover, seemed to confirm the prophets of gloom and, with an unchanged Bank rate, indices began to wear a distinctly worried look.

Occasionally there was a glimpse of blue between the clouds. Among electricals, too, the Chancellor's squeeze was making itself felt. Vactric holders woke to a Monday morning shock. On the appointment of a receiver and manager, the Ordinaries crashed nearly 6s to 7s 7½d and the "A" just under 4s to 7s 1½d. After a few days vacillation as "bears" covered themselves, the "A" had relapsed to 6s 3d.

Just as the motor cuts indirectly punctured the price of Dunlop, so Vactric's decline brought reactions in Arusha Industries, which had bid for them at 55s, and Lombard Banking owners of a former Vactric hire purchase subsidiary.

Another outstanding feature was the rise and fall of Crabtree. Galvanised by grapevine gossip, and ignoring official take-over denials, the shares climbed to 39s 6d before yet another denial brought them back to earth at 34s 6d. Meanwhile another merger favourite, E. K. Cole, was pushed up to 29s and Dimplex gained 2s 3d to hit a 48s peak.

But in spite of a sharp recovery in profits and a bumped-up dividend, J. and F. Stone, whose year ended on

30 June, lost a few pence. And the "minus" sign went against most of the leaders including EMI, down 1s 6d to 46s, Philips and GEC, who shed 2s 9d to 35s 9d. AEI, Crompton, English Electric, Parsons, Reyrolle and Thorn were 1s to 1s 9d lighter.

The "easier H.P." plea sent by the Radio Industry Council to the Board of Trade, reinforced by disappointing statistics of retail radio and television sales, shows that, on the domestic side at least, credit restrictions are taking a heavier toll. And the latest Federation of British Industries survey, based on the answers of 728 chairmen and managing directors to an FBI questionnaire, clearly illustrates that businessmen are becoming even more cautious.

Asked about their experience of profit margins over the four months to the end of September and their expectations for the next four, 53% said "same again" and 37% answered "down." Only 9% of the replies were expansive. Which perhaps goes part of the way towards explaining why the announcement of Decca's record results for the year to end-March—with turnover £3.4 up at £25.2 million, net profits £229,000 higher at £1,260,000 and total dividend hoisted from 20% to 23½%—caught the shares at 46s 1½d, a mere 7½d above the 1960 "low."

There was still plenty of money around, however, as was proved by the response to the LCC's £20 million offer of 6% stock. Lists closed after only a minute with the issue heavily oversubscribed.—*From our City Correspondent.*

Alwyn Holdings Ltd.

This concern, which controls Rashleigh Phipps Ltd., is raising the dividend to 12½% for the period of incorporation to 30 June last, compared with the 10% forecast when it became a public company in June, 1959. Group profits, before tax, for the period, amounted to £190,790, of which £186,732 is applicable to the year ended 30 June. Balance for the year compares with £139,352 for the wholly owned subsidiaries in the previous year. Taxation absorbs £101,957, leaving a net profit of £88,833.

Anglo-Portuguese Telephone Co.

It is proposed to issue 1,190,000 new Ordinary £1 shares to Ordinary and "A" Ordinary stockholders on a one-for-one basis at 21s each. The new shares will rank for the final dividend for 1960.

Associated Electrical Industries

Following an expressed preference by the majority of shareholders, this concern is to pay half-yearly dividends in future. The second quarterly dividend

of 2½% announced on Tuesday will be the last. Some time ago a questionnaire was sent to shareholders seeking their views. It is evident that many consider any advantages of a quarterly dividend are probably offset by the extra paper work involved.

Sydney S. Bird and Sons

This concern, which makes components for the electronic industry, is not paying an interim dividend "in view of adverse trading conditions."

A. C. Cossor Ltd.

An attempt to upset the present board failed at last week's annual general meeting. Sir Miles Graham, chairman, revealed that the order book was in its best position for many years. For 1961-62, instructions had already been received to proceed with over £1½ million of orders. For 1962-63, the figure was now £725,000 and, for 1963-64, £250,000. He hoped that in due course he would bring the company back to the position it should hold. The company have just purchased a small firm

complementary to its radar section, but no bids had been made for Cossor, he added.

Crabtree Electrical Industries Ltd.

Persistent rumours of takeover negotiations were squashed by the directors last week in a statement that "no negotiations have taken place or are contemplated and they have no knowledge of anything likely to have prompted this rumour."

Ever Ready Trust Co. Ltd.

In announcing a gross revenue of £79,210 for the six months ended 30 Sept. last, compared with £65,405 for the same period of last year, the directors are recommending an interim dividend of 8%, against 7% last time.

Rangoon Electric Tramway and Supply Co.

Having agreed with the Burma Government on compensation for the assets of the undertaking, which was taken over in 1953, the liquidators now estimate that they will be able to distribute at least 9s per 15s share. Agreed compensation is kyats 2,22,98,373 plus interest.

George H. Scholes and Co. Ltd.

An adjoining factory, which was surrounded on three sides by their existing land, was acquired by the company earlier this year. This will greatly facili-

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	253,091	102,010	80	25	15/4½	13/9
1957	259,020	101,722	80	25	10/11	10/6½
1958	303,825	118,567	70	20*	19/6	11/3
1959	378,228	165,125	91	30	36/-	13/4
1960	460,429	201,746	74	27½†	35/1½	33/6

* Plus 40% capital bonus. † Plus 50% capital bonus.

tate development of the whole area, Mr F. J. Pearce, chairman, has told shareholders. The ground floor has already been converted into a store and new offices are being erected to release space in the works for further productive capacity.

J. and F. Stone Lighting and Radio

This retailing organisation had a better year in the period ending 30 June last. Group trading profit increased to £915,802 (£617,121), and after charging taxation at £416,500 (£246,000), the net profit is £386,269 (£280,775). A final dividend of 22½% raises the total distribution by 5% to 35%.

Dividends Declared

Babcock and Wilcox. Interim 5% (same).

Engineering and Lighting Equipment Co. Interim 7½% (5%) on larger capital.

Greengate and Irwell Rubber Co. Interim 5% (same).

Glenfield and Kennedy Holdings. Interim 5% (same).

Mavor and Coulson. Interim 4½d per share (same) but on increased capital.

COMMERCIAL INFORMATION

tracts Open at Home . . .

iven are the final for receipt of ders unless otherwise stated.

-Edinburgh C.C. Provision and erectage lighting equipment and control Trinity Academy Secondary School. Applications to City Architect, City Chmbrs, : date.

-Bristol C.C. Supply of lamps, transformers, capacitors, sundries, etc., for year.—Advertised 6 Oct.

-Larbert. (Item 6.) Electrical installation in six houses for Royal Scottish Institution and in four houses for : Mental Hospital Board of Management. Applications to Secretary, D. M. : Board of Management Offices, : Scottish National Institution, Larbert, : date.

-Kingston upon Thames. Roof electrical ancillary works, etc., at Depot.—See 29 Sept. issue.

-Lancs C.C. Rewiring of Thornton ys County Secondary School. Application reference A/G, to County Architect, ix 26, County Hall, Preston, by ite.

-Felton P.C. Erection of 30 60 W lamps on concrete columns.—See sue.

-Renfrew C.C. (3) Electrical installation proposed primary school at Larkreenock. Applications to County : Urquhart, County Bldgs, Paisley, : date.

-S. Devon Water Board. Supply of p.h. at a 286 ft head duplicate and ancillary equipment for Sheldon Station.—See 6 Oct. issue.

-Bangor B.C. Supply of 30 fluorescent/brackets suitable for attachment wood poles. Borough Surveyor's own Hall, Bangor, N.I.

-Ealing B.C. (a) Supply of 88 sodium lanterns/lamps/gear; (b) and erection of 85 25 ft steel —Advertised 15 Sept. issue.

-Lewisham B.C. Replacement of iting with sodium on 207 columns ply and installation of 51 Group : columns, 226 single and 17 twin sodium lanterns/lamps/gear and 15 W lamps/gear. Borough Engineer, all, S.E.6.

-Cardiff C.C. Complete £38,000 installation, by contractors on I.C. roll, in proposed Teachers' College, Cyncoed.—See 29 Sept.

-Elre C.I.E. Form 137. Supply of or premises and automobiles.—See issue.

-Manchester C.C. (a) Electrical on and (b) supply and erection of r/goods lift in new hostel block, Training College.—See 13 Oct.

-Manchester C.C. Replacement bat-motor vehicles for year to 31 Dec.. General Manager, Corpn. Transport i Piccadilly, Manchester.

-Newbury B.C. Supply and erection on Rd Pumping Station of two h 186,000 g.p.h.) and three (each g.p.h.) centrifugal pumps for unsewage.—See 13 Oct. issue.

-Whitchurch U.D.C. Phase 1. erection and wiring of 45 150 W lamps on 25 ft concrete columns 85 W sodium on 15 ft columns.— :d 29 Sept. issue.

-Dumbarton C.C. Erection of 16 linear sodium cut-off lanterns on el columns with 6 ft outreach plus eep Left" bollards complete with cable, control pillar and gear for

Auchenkiln Junction, A80, roundabout. Applications to County Lighting Superintendent, W. Arthur, 24 George Sq, Glasgow C.2, by above date.

28 Oct.—Eaniskillen R.D.C. Provision of nine fluorescent lamps on concrete columns at Cornagrade. Engineer and Surveyor, A. Stephenson, R.C. Offices, Cornagrade. Deposit £2 2s.

28 Oct.—Manchester C.C. Electrical installation in smoke chamber, Central Fire Station. City Architect, P.O. Box 488, Town Hall.

29 Oct.—Dagenham B.C. Applications for inclusion in approved list of contractors for school maintenance electrical work to Borough Engineer and Surveyor by above date.

29 Oct.—Heston and Isleworth B.C. Rewiring, supply and fixing of power outlets in: Contract 1, 92 houses; Contract 2, 102 houses; and Contract 3, 105 houses on Worple estate, Isleworth.—Advertised 13 Oct. issue.

31 Oct.—Leighton Buzzard U.D.C. Erection of 28 Group "A" Stanton columns complete with lanterns/gear along A4012; resiting including the provision of new lanterns of 17 Group "B" columns and the erection of 33 additional Stanton columns/lanterns along Stanbridge Rd.—See 13 Oct. issue.

31 Oct.—Oldham C.B. Conversion of 15 mechanical public clocks to electric drive or electric wind.—Advertised 29 Sept. issue.

31 Oct.—Taunton B.C. Supply of (Item d) electrical goods for year from 1 Jan., 1961. Town Clerk, Municipal Bldgs.

31 Oct.—Warrington B.C. Contract 1. Supply and erection of submersible well pumps, horizontal centrifugal pumps, switchgear and hydraulic instruments for Houghton Green. Contract 2. Small horizontal centrifugal pumps, etc., for Risley Pumping Station. Water Engineer, Pinners Row.

31 Oct.—Wrexham B.C. (a) Electrical installations in 40 dwellings, Tanat Way and Sutton Drive; (b) supply of consumers' units and cabinets. Borough Engineer and Surveyor, 31 Chester St.

1 Nov.—Harrow B.C. Supply and installation of 120 200 W sodium units on 30 ft steel columns and removal of existing installation along Edgware Rd, A5. Borough Engineer, 48 Uxbridge Rd, Stanmore. Deposit £2.—Advertised in this issue.

1 Nov.—Kingston upon Thames B.C. Erection only of 45 Group "A" columns/140 W sodium lighting and conversion of 125 Group "A" mercury units to sodium.

Borough Surveyor, Town Hall. Deposit £2 2s.

1 Nov.—North Down R.D.C. (a) Supply and erection of fluorescent street lighting in 15 villages. Clerk, 2 Church St, Newtownards.

1 Nov.—Wombwell U.D.C. Supply of 250 3 cu ft 240 V refrigerators in quantities of not less than 50. Tenders indicating guarantee/free maintenance to Council Clerk, F. Potter, Town Hall.

4 Nov.—Down C.C. All-electric lighting and heating installation in Child Health and Welfare Clinic, Knocknee Ave, Kilkeel.—See 13 Oct. issue.

4 Nov.—Oldbury B.C. Erection, on fixed-price basis, of 88 Class "B" concrete columns, supply and fitting of post-top lanterns with lamps/control gear/time switches plus resiting of 26 units and conversion to MBF/U operation along various roads. Borough Engineer and Surveyor, Municipal Bank Chmbrs. Deposit £2 2s.

5 Nov.—Longbenton U.D.C. Supply and erection of 64 sodium units and 474 post-top lantern filament Group II street lighting units. Engineer and Surveyor, A. E. Sweetman, Council Offices, Forest Hall, Newcastle-on-Tyne 12. Deposit £3 3s.

5 Nov.—Middlewich U.D.C. Fluorescent lighting installation in (part) Victoria Bldg, Lewin St. Surveyor, D. A. Stubbs, Victoria Bldg.

5 Nov.—New Windsor B.C. Supply of (Item 15) lamps and (Item 21) fittings and cable for year to 31 Dec., 1961.—See 6 Oct. issue.

7 Nov.—Swanage U.D.C. Electrical installation in new depot at King's Rd West. Engineer and Surveyor, P. S. Browne, Town Hall.

10 Nov.—Northwich R.D.C. Supply and installation of 40 Group "A" concrete columns with sodium lamps/lanterns/gear. Engineer and Surveyor, Whitehall, Hartford, Northwich. Deposit £2 2s.

11 Nov.—New Windsor. Electrical installations in two maisonnettes at Clewer New Town.—See 13 Oct. issue.

11 Nov.—Oldbury B.C. Erection, on fixed-price basis, of 20 Class "B" concrete columns, supply and fitting of post-top lanterns/lamps, control gear/time switches on Lion Farm estate. Borough Engineer and Surveyor, Municipal Bank Chmbrs. Deposit £2 2s.

14 Nov.—N.A.T.O. Infrastructure. Provision and proving of a very low-frequency radio-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 110 queries answered this week

Stamford Electrical Co., makers of motors—address for? T.E.—Arthur Lyon and Co. (Engrs.) Ltd., Park Wks, Stamford, Lincs.

"Mini-Maid" vacuum cleaners—makers of? M.A.—Bylock Electric Ltd., South St, Enfield, Middx.

"Hameo" appliances—repairers of? S.E.E.B.—Campion Products Ltd., 378 Malden Rd, Worcester Park, Surrey.

"Castle" sterilisers—agents for? M.A.N.W.E.B.—The Amalgamated Dental Co. Ltd., 22 Broadwick St, W.1.

"Mitchell" water heaters—makers of? K.L.—Mitchell Electric Ltd., Meco Wks, 88-89 Tennant St, Birmingham 15.

"Penberthy" pumps—agents for? W.W.—W. H. Willcox and Co. Ltd., 49 Southwark St, S.E.1.

"Samovar" percolators—makers of? L.E.B.—Wm. May and Son (London) Ltd., Dominant Wks, Elthorne Rd, N.19.

"Sumlock" calculating machines—makers of? T.E.—Bell Punch Co. Ltd., 39 St. James's St, S.W.1.

"Panescent" lighting fittings—makers of? F.W.J.E.I.—Sylvania Electric Products Inc., 60 Boston St, Salem, Mass., U.S.A.

"Kenmore" washing machines—repairers of? E.E.B.—Home Electric Washer Co. Ltd., 17 Aylmer Parade, North Rd, N.2.

telegraph transmitting station in North of England.—Advertised 13 Oct. issue.

16 Nov.—Ipswich B.C. Electrical installation in proposed 56-person aged people's home, Chantry estate. Borough Engineer and Surveyor, 19 Tower St. Deposit £2 2s.

17 Nov.—Birmingham C.C. Socket-outlet installations and lighting installation repairs in 250 houses at Acock's Green. Housing Manager, J. P. Macey, Bush Hse, Broad St.

17 Nov.—Fylde Water Board. Supply of flow recorder panel and hydraulic measuring equipment.—Advertised 13 Oct. issue.

14 Dec.—Matlock U.D.C. Supply and installation complete of nine sewage pumps at four pumping stations in Darley Vale.—See 6 Oct. issue.

No date stated—Haddington B.C. (Item 6). Electrical installation in office reconstruction scheme at Caryle Rooms, Lodge St; and (Item 7) electrical work in 22 houses in seven blocks on Abercroft site.—See 13 Oct. issue.

No date stated—N. of Scotland H.E.B. 60 MVA transformer for Persley substation, Aberdeen.—Advertised 13 Oct. issue.

No date stated—St. Faith's and Aylsham R.D.C. Supply of columns, lanterns, lamps and auxiliary equipment.—See 13 Oct. issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

27 Oct.—S. Africa. 90,000 2.8 V air-depolarised cells. Secretary, Union Tender Board, P.O. Box 371, Pretoria. B.o.T. (ESB/26627/60).*

1 Nov.—America. One 10.5 MVA and one 6 MVA 3-ph. outdoor transformers. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center, Denver 25. B.o.T. (ESB/26481/60).*

1 Nov.—America. 3,743 10 in. diameter suspension insulators. Dept. of the Interior, Bonneville Power Admin., 1001 N.E. Lloyd Boulevard, Portland, Oregon. B.o.T. (ESB/26623/60).*

1 Nov.—Ceylon. Air conditioning plant for Stanley and Laksapana control rooms. Electrical Engineer, Contracts and Supplies, McCallum Rd, Colombo. B.o.T. (ESB/26494/60).*

1 Nov.—Pakistan. Seven items p.v.c. flat twin cables from 3/029 to 7/064 in quantities up to one million yd. Director

of Stores, W.P.D.A., Gardee Trust Bldg, Lake Rd, Lahore. B.o.T. (ESB/26696/60).*

1 Nov.—Sudan. 20 7.4 cu ft refrigerators. Director of Stores and Equipment, Khartoum North. B.o.T. (ESB/26629/60).*

7 Nov.—India. Five items o/h travelling cranes, three to 30 tons and two two-ton semi-Goliath cranes. Deputy Chief Mechanical Engineer, Steel Foundry, Chittaranjan Locomotive Wks, West Bengal. B.o.T. (ESB/26677/60).*

7 Nov.—India. 11 kV cables for Sumar Power Station. Additional Chief Engineer (Electrical), Assam State Electricity Board, Lachumiere, Shillong. B.o.T. (ESB/26673/60).*

8 Nov.—Ceylon. Generating sets for Ratagama, Imaduwa and Galle. Electrical Engineer, Contracts and Supplies, McCallum Rd, Colombo. B.o.T. (ESB/26490/60).*

17 Nov.—Iran. 30 battery-operated fork-lift trucks to lift 2,000 kg to 12 ft. General Customs Admin., Ministry of Customs and Monopolies, Teheran. B.o.T. (ESB/26669/60).*

28 Nov.—Sudan. Two 15 cu ft 110 V d.c. refrigerators for Sudan Railways. Controller of Stores, Atbara. B.o.T. (ESB/26679/60).*

30 Nov.—India. Two 250 kVA transformers for Sumar Power Station. Additional Chief Engineer (Electrical), Assam State Electricity Board, Lachumiere, Shillong. B.o.T. (ESB/26676/60).*

5 Dec.—India. 125 V battery banks, chargers and d.c. control boards for Umiam (Barapani) Hydel Project. Additional Chief Engineer (Electrical), Assam State Electricity Board, Lachumiere, Shillong. B.o.T. (ESB/26672/60).*

10 Dec.—India. Power line carrier communication equipment for Umiam (Barapani) Hydel Project. Additional Chief Engineer (Electrical), Assam State Electricity Board, Lachumiere, Shillong. B.o.T. (ESB/26675/60).*

Gazette Announcements

COMPANIES ACTS

Inter-city Electric Machines Ltd. Meeting of creditors to be held at 233 High St, Poole, on 21 Oct., at 10.30 a.m.

Tape Recorder Service Co. Ltd. Meeting of creditors to be held at 194 Bishopsgate, E.C.2, on 25 Oct., at 12 noon.

Penelectric Appliance Co. Ltd. Meeting of creditors to be held at Law Institute, Albion Pl, Leeds, on 26 Oct., at 2.30 p.m.

R. Giddings and Co. Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 24 Oct. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, by 1 p.m., 22 Oct.

A. and R. Direct Supply Co. Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 24 Oct. Persons intending to appear to notify Lipton and Jefferies, 39 Jermyn St, S.W.1, by 1 p.m., 22 Oct.

Minisales Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 24 Oct. Persons intending to appear to notify H. E. Goodrich, 9 Union Court, Old Broad St, E.C.2, by 1 p.m., 22 Oct.

Elizabethan Eng. Co. Ltd. Mr H. E. Hassell, 8 Queen St, E.C.4, and Mr H. C. Hedges, 4 Charterhouse Sq, E.C.1, appointed joint liquidators at extraordinary general meeting on 12 Oct. for the purpose of voluntarily winding-up.

BANKRUPTCY ACTS

Receiving Order

Slough. J. S. Sizmore, electrical retailer and contractor, of 12 Stoke Rd, Slough. Receiving order dated 7 Oct.

Intended Dividend

Truro and Falmouth. G. B. Solomon, radio and electrical dealer, carrying on business as St. Columb Radio, at 57 Fore St, St. Columb. Last day for receiving proofs for intended dividend: 25 Oct., to trustee: J. E. Ellis, 50 The Terrace, Torquay.

CONTRACTS PLACED

Cheadle and Gatley U.D.C. Supply and erection of 39 Group "A" concrete columns with 140 W sodium lamps/lanterns, Cohen Bros. (Electrical) Ltd.

Cheltenham B.C. Electrical installations in 38 dwellings at Maud's Elm, M. B. Owen, £1,298. Recommended.

Darlington T.C. Electrical installation in practical block, Salters La Open-Air School, Cox-Walkers Ltd., £407.

Gateshead T.C. Electrical installation in Elgin Secondary Technical School, Campbell and Isherwood Ltd. Recommended.

Guildford B.C. Electrical services in new central library, T. A. Boxall and Co. Ltd., £5,965. Recommended.

Hatfield D.C. Supply and erection of 38 tubular steel columns and lanterns for Oxlease development areas lighting, Abacus Municipal Ltd.

Seaton Valley U.D.C. Electrical installations in 86 new houses, W. Hinton.

Sheffield C.C. Electrical installations in Broomgrove and Woodville hostels, T. W. Sampson and Co. Ltd., £13,083 and £11,017. Recommended.

Wattford B.C. Supply, erection and wiring of 93 concrete columns along A405, Midland Lighting and Bldg Ltd., £3,613.

Wessex Hospital Board. Lift installation, "H" block, Christchurch Hospital, Pickering Ltd., £4,278; electrical work in E.N.T. wards, Royal Hants County Hospital, and in stages I and II, Lord Mayor Treloar Hospital, Dicks Ltd., £1,498, £4,191 and £2,030, respectively. Recommended.

Willesden B.C. Electrical installations in central library extension, C.J.L. Electrical Ltd., £1,306. Recommended.

TRADE NOTES

Changes of Address. Line Equipment Ltd. have moved to 71a Queen Victoria St, E.C.4. The telephone no. remains City 1841.

Conduit Distributors Ltd. have this week moved to new premises at Leek St corner, King's Cross Rd, W.C.1. Telephone: Terminus 7842.

In view of the rapid expansion of the Instrument Division of E.M.I. Electronics Ltd., the Development Section of that Division will in future operate from Wells, Somerset, instead of Hayes, Middlesex.

The Birmingham office and depot of Oldham and Son Ltd. is now at Norwood Rd, Bordesley Green, Birmingham 9.

New Telephone No. The telephone no. of Leicester, Lovell and Co. Ltd. has been changed to Rownhams 2131.

BEAMA Contract Price Adjustment Formulae. For Electrical Machinery and Equipment. For purposes of calculating variations in (a) "Rates of Pay"—the rate of pay for adult male labour at 14 Oct.,

1960, shall be deemed to be 204s 6d; (b) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 14 Oct., 1960, is 116.7* (181.0*).

For Turbo-Generators and Allied Plant. For purposes of calculating variations in: (a) "Rates of Pay"—the rate of pay for adult male labour at 14 Oct., 1960, shall be deemed to be 204s 6d; (b) "Cost of Material"—the index figure for materials used in the Mechanical Engineering Industry at 14 Oct., 1960, is 126.3* (189.8*). "Blast Furnaces and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)." 189.5*. Other Steel Goods, excluding tubes (1958 S.I.C. ref. 311/2). 129.1*. The price of brass condenser tubes $\frac{1}{2}$ in. o/d 18 s.w.g. on 14 Oct., 1960, is 3s 11 $\frac{1}{2}$ d per lb. *Provisional figure.

The figures in parentheses shown above relate to the earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954=100.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Dishtron. 807,621. Class 7. Dish-wash machines. Halpins (Dishtron) Ltd., 57- London Rd, Southampton, Hants.

Emleco. 801,835. Class 9. Scientific electrical apparatus, etc. E.M.I. Electron Ltd., Blyth Rd, Hayes, Middx.

Rotoshine. B801,656. Class 7. Polish machines (not domestic). B801,657. Class Electric domestic polishing machines. Ltd., Radio Wks, St. Andrew's Rd, Ca bridge.

Slumberland. 801,848. Class 10. Electric blankets, etc. Slumberland Ltd., Redfern Tyseley, Birmingham 11.

BUSINESS PROSPECTS

l. Finch Watson, Ramsbottom at engineering works on Marl-
1 land.—The Calico Printers
extensions to their calendar
ad Oak Print Wks.

C. Tender: 137 houses, 84 flats.

. E. F. Hamilton-Parks, 116
V.I., architect for planned Ayers
iw factory.

t-Furness. Continuous casting
d at Barrow Steelworks Ltd.

Harvey, Struth and Co., 77
W.I., surveyors for block of
etc., at Marina, Devonshire Rd,
Rd.

m T.C. Tender: Aged persons'
field Rd, Perry Barr, for Wel-
tee. Architect.—Home for the
l, Chamberlain Gdns, Lady-
tect.

ackland. Hardy Ltd. plan ware-
gate St. Architects: Pigg and
gate St.

. Daniel Thwaites and Co., Sta
in rebuilding of Waterloo Hotel.
R.C. authorities plan new school
s Abbey.

. Holmes and Co. plan exten-
ks off Bradford St.

Sir John Burnet, Tait and
dford Sq, W.C.I., architects for
Vue boys' grammar technical
de Young and Bernard Engle,
r Margaret McMillan Training

L. W. Clark and Ptnrs, 55 Pall
architects for £½ million fac-
l at Ongar Rd for Thermos.

'C. Provision of Group "A"
trunk road, A264 (part), at
ied.

r. R. T. James and Ptnrs, 6
venor Pl, S.W.I., architects for
£60,000 offices.

Large scale development is to
Butetown slum, including two
ver blocks of flats. City Architect.

R. D. Batchelor, Luton, Chat-
ictory at Princes Ave.

-Street. Howardsgate Holdings,
n City, plan warehouse, offices,
w Hill Farm.

Corporation to make available
acres, Charter Ave industrial
to Hibberd and Sons, Warwick

l. Jessups (Romford), London
rd, plan factory for body build-
and repair of motor vehicles,
Rd.—N. Harris and Sons plan
building at Dominion Wks,
Rd.—Ratcliffe and Son (Printers)
ons to 160-162 High Rd works.

F.C. Tender: Final development
ark housing site: 48 houses, etc.
rveyors: Morham and Brochie,
St, Edinburgh.

a. Darlington Co-op. and Indus-
r, Priestgate, plan departmental
store in Tubwell Rd. C.W.S.
Dept., 9 Westmorland Rd, New-
uel Smith, Old Brewery (Tod-
residential hotel in town.

B.C. Tender: 120 dwellings,
housing estate, and 12 Whitley
Architect and Bldgs Surveyor.
70,000 improvements planned for
partment at Royal Infirmary.

T.C. plan 48 houses on Newton
Engineer.—R. E. Coleman, Carr-
ct 68 Carrville houses.

ie. Photax Ltd., 1 Charlotte St,
actory of plot 32, Brampton Rd

ag of Yorks C.C. Tender: Three-
school at Norton. Also home
Norton. Architect, Beverley.

Egham, Surrey. L.C.C. plans development
of Shoreditch Training College at Egham;
cost: £485,000. Plans by Architects' Depart-
ment, County Hall, S.E.1.

Eltham, Kent. Tender: Office block at
Eltham Palace for Army Institute of Edu-
cation. Architects: Bryan and Norman
Westwood and Ptnrs, 21 Suffolk St, S.W.1.

Felling. Arthur and Kirkup, 13 Swinburne
St, Gateshead, architects for meat packing
plant and slaughterhouse at Green La, for
R. A. Dodds, 178 Butcher Market, New-
castle.

Fylde Water Board. Tender: Double-
storey office and stores, Coleridge Rd Depot,
Blackpool. Engineer to the Board, Sefton
St, Blackpool.

Gateshead B.C. Tender: Chandless rede-
velopment area, Phase II, 232 dwellings;
(2) Mendip Gdns, Lobley, 12 dwellings and
six four-bedroom houses; (3) Yetholm Rd,
30 dwellings; (4) Rectory site, Bensham Rd,
52 dwellings. Surveyor, Swinburne St.—E.C.
plan £9,000 additions to The Cedars Special
School. Engineer.—£20,000 old people's lun-
cheon club planned for Wrekenton. Engineer.

Glasgow. £½ million scheme planned to
extend Glasgow Museums and Art Galleries
at Kelvingrove by Corporation Museums
and Art Galleries Committee.

Guildford. W. Earle-Yeates, 154a Church
Rd, Hove, architect for planned factory on
industrial estate for Transformers and
Rectifiers Ltd.

Gulbourn U.D.C. Tender: 19 bunga-
lows, Lazenby. Surveyor.

Hyde, Ches. B.C. Tender: 32 houses, 20
maisonnettes and 20 flats, Lilly St housing
estate. Surveyor.

Isle of Wight. C.C. plan £63,000 factory
at Binstead to accommodate Columbia
Products, 1 Dukes Ave, W.4.

Kidderminster. Wallis Gilbert and Ptnrs,
5 Cromwell Rd, S. Kensington, S.W.7,
architects for £350,000 administration block
planned for Carpet Trades Ltd., Mill St.

Langley, Bucks. Warehouse extensions at
considerable cost planned by Pasolds Ltd.,
Langley.

Leeds T.C. (a) Scheme 875, 86 bungalows
and ten houses, Cardigan La, Moorside,
Belle Isle and Gipton; and (b) Scheme 870,
32 garages, Quarry Hill flats. Architect.

Leics C.C. Extensions planned to Blaby
Junior, Ibstock Secondary and Burbage
Hastings High schools. Total cost £188,823.

London. N. Raymond Spratley and Ptnrs,
9 Hertford St, W.1, architects for £35,000
Capitol Hse, and office block at Green Lanes,
Winchmore Hill, for Rodwell Group.—
N.W. Royal College of Physicians, Pall
Mall East, S.W.1, plan building at Someries
Hse site, St. Pancras.—S.E. E. R. Collister
and Assoc., 70 Victoria St, S.W.1, architects
for Gardiner and Gulland's warehouse
planned at Staplehurst Rd, S.E.13.—Tunnel
Glucose Refineries plan amenities building
and additional storey over Tunnel Ave
laboratory.—J. Stone and Co., Anchor and
Hope La, plan multi-storey office block.—
S.W. Ministry of Works plan acquisition
of block, Bridge St/Parliament St/New
Scotland Yd/Embankment, for Government
offices.—Richardson and Davies, 57 Queen
Anne St, W.1, quantity surveyors for shops
and flats at Lower Sloane St and Pimlico
Rd for Cadoxan Estates.—A. Vernon and
Ptnrs, 5 Buckingham Pl, S.W.1, architects
for Redifon's proposed extensions.—L.C.C.
Welfare Committee have approved scheme
for old people's home at 367 Fulham Rd
at £164,760.—Education Committee approves
development of Mount Clare and Devon-
shire Hse sites, Wandsworth, for use of
Garnett Training College for Technical
Teachers, cost £461,000.—W. City Centre
Properties, 32 Victoria St, S.W.1, plan re-
development of 45 Park La.—Cecil Burns
and Guthrie, 11 Calverley Park, Tunbridge
Wells, architects for six-storey nurses' hostel,
Wimpole St, W.1.—R. H. McEwan, 10

Carteret St, S.W.1, quantity surveyor for
£120,000 warehouse rebuilding at Heathfield
Terr, W.4, for Army and Navy Stores Ltd.

Luton. Swannell Stove Enamelling Co.
plan new building for metal work at 330
Selbourne Rd.

Manchester. Tender: Erection of holiday
camp and motel on south west coast: 300
chalets with baths, three dining halls, recep-
tion centre, two ballrooms, two snack bars,
four licensed bars, theatre, cinema, service
station, etc. Burkland Mayfair Bldgs, 19
Downing St, Manchester 1.—T.C. Tender:
Contract 352, 42 dwellings, Butler St, and
354, 229 dwellings, Collyhurst St. Director
of Housing, Town Hall.—Heaton Mills
Printing Co. plan extensions to Heaton
Mills, Higher Blackley.

Newcastle T.C. Tender: 181 houses, 16
flats and garages, Newbiggin Hall estate,
Groups 14, 17, 18 and 19. Architect.—
E.C. plan £6,000 improvement of Whickham
View School electric lighting.

Northallerton. Tender: Friarage Hospital
nurses' home extensions, for Newcastle Hos-
pital Board. Architects: Mortimer Ptnrs,
Ainderby Hall.

Norton-Radstock U.D.C. Tender: 40
dwellings, Springfield, Radstock, comprising
flats and maisonnettes, Redwood, Miles and
Wills, architects, 18 Gt. George St, Bristol.

Oldbury B.C. Tender: (a) 32 dwellings;
(b) 30 dwellings; and (c) 55 dwellings on
Lion Farm estate. Engineer.

Redditch. Wm. Tyers and Co. plan fac-
tory at Beoley Rd.—Reynolds T.I. Alu-
minium plan extensions to tube mills,
Studley Rd.—Super Oil Seals and Gaskets
plan extension to factory at Studley Rd.—
Road Rollers Ltd. plan new plant depot
and offices, Studley Rd.

Rochester T.C. Tender: Warren Wood
redevelopment, Stage 5; 38 three-bedroom
houses and garages, Earl estate, Part IC;
63 three-bedroom houses and garages. Sur-
veyor.

Rotherham. Steel, Peach and Tozer,
Rotherham, plan amenity centre and offices,
The Ickles, Sheffield Rd: also a maintenance
workshop at Templeborough Wks.

Shaftesbury B.C. Tender: Four houses
and five bungalows, St. James St. Clerk,
28 Bell St.

Sheffield. Stanley Works (Great Britain),
Rutland Rd, Sheffield 3, plan industrial
development on land at Woodside La and
Birley St.

Smethwick. W. E. Shotton and Co. plan
factory extensions, Rabone La.—Dartmouth
Auto Castings Ltd. plan production and
cupola building, Dartmouth Rd.—Guest,
Keen and Nettlefolds plan new implement
shop, Thimblemill Rd.

Spennymoor U.D.C. 13 houses, Byers
Green; and 16, Tudhoe Moor planned.
Gray and Ptnrs, Camden St, North Shields,
architects.

Staines. Petters Ltd. plan new research
centre.

Stanley U.D.C. Tender: 22 two-bedroom
houses, Church La estate, Outwood. En-
gineer and Surveyor: J. Hustwit, Coach Rd,
Outwood.

Stockton-on-Tees. Ashmore, Benson Pease
and Co. plan engineering works extensions,
Bowesfield La.—Newcastle Hospital Board,
Benfield Rd, Newcastle, plan new X-ray
department at Stockton and Thornaby Hos-
pital. Board's own architect.

Thornaby-on-Tees T.C. 19 Lanehouse Rd
bungalows planned. Engineer.

Tottenham B.C. Tender: 14 dwellings in
one block, Braemar Rd/Kent Rd. Engineer.

Ware. Wood Bros. (Brimmsdown), London
Rd, Ware, plan six factories at Marsh La.

West Bromwich. Johnson Iron and Steel
Co., Church La, plan rolling mill, ancillary
mill, offices, etc., at Church La.

Whitley Bay. F. G. Frizzell, 80 Portland
Pl, W.1, architect for United Automobile
Services' garage extensions.

Widnes B.C. Tender: Wake Deacon Gram-
mar School for Girls. Architect, Brendan
Hse, Widnes Rd.

Wores C.C. Tender: Bromsgrove Rubery
infants' school and clinic. Architect.

MEETINGS TO NOTE

THURSDAY, 20 OCT.

I.E.E. (N. Midlands). "The Supply Authorities' Problems," H. Anderson; "The Consultants' Problems," C. H. Nicholson; and "The Users' Problems," A. Minty. Lecture Theatre, Y.E.B. Offices, Ferensway, Hull. 6.30 p.m.

I.E.E. (N.E. Graduate and Students). "Electrical Phenomena at Very Low Temperatures," R. E. Hayes. Grey Hall, King's College, Newcastle. 6.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. "Introduction to the Age of Nuclear Power," W. G. Busbridge. Social Hall, Crompton Parkinson. 7.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Scotland). "Process Planning and Machine Tool Control Systems," A. Tack and J. Brett. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 7.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Southern). "Equipment Peripheral to Digital Computers," E. J. Petherick. Polygon Hotel, Southampton. 7.15 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Frequency Variations of Quartz Oscillators and the Earth's Rotation in Terms of the N.P.L. Caesium Standard," L. Essen, J. V. L. Parry and J. McA. Steele. Cavendish Laboratory. 8 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (E. Midlands). "Instrumentation at the British Railways Research Department, Derby," J. H. Littlewood and A. Kettley. University, Leicester. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Grange-mouth). "Analytical Instruments for Process Control," Dr D. G. Stevenson. Leapark Hotel. 7 p.m.

DIESEL ENGINE USERS' ASSOCIATION. A.G.M. and "Latent Heat Cooling and Waste Heat Recovery," C. Brett-Littlechild. Institute of Marine Engineers, 76 Mark La, E.C.3. 2.30 p.m.

S. WALES INSTITUTE OF ENGINEERS. A.G.M. and presidential address, C. C. Bleach. Park Pl, Cardiff. 6 p.m.

FRIDAY, 21 OCT.

I.E.E. (Southern). "The Application of Irradiation in Industry," M. C. Crowley-Milling. S.E.B. Showrooms, Newport, I.W. 6.30 p.m.

I.E.E. (W. Wales). Annual dinner/dance. Langland Bay Hotel, Swansea. 7.30 p.m.

BIRMINGHAM ELECTRIC CLUB. Annual dinner. Grand Hotel.

JUNIOR INSTITUTION OF ENGINEERS. "Boiler Management in Small Plants," L. Clegg. 14 Rochester Row, S.W.1. 7 p.m.

A.S.E.E. (Aldershot and Districts). Dinner/dance. Victoria Hotel.

A.S.E.E. (Liverpool and District). "Nuclear Power and Propulsion," R. V. Moore. Lecture Theatre, Chadwick Physics Laboratory, Liverpool University. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "Silicones and Their Applications in the Electrical Industry," J. H. Davis. Grand Hotel, Hanley. 7.30 p.m.

MONDAY, 24 OCT.

I.E.E. (E. Anglian). "Electrical Installation Practice," E. J. Sutton. Electric Hse, Ipswich. 6.30 p.m.

I.E.E. (N. Eastern). "Safety in the Utilisation of Electricity," S. J. Emerson. Neville Hall, Westgate Rd, Newcastle. 6.15 p.m.

I.E.E. (N. Western). Discussion. "Selection of Students for Appropriate Courses," Bolton Technical College. 6.15 p.m.

I.E.E. (S. Midlands Electronics and Measurement Group). "Automatic Control of Machines for Assembling Bicycle Parts," A. V. Hemingway and R. L. Dressler. James Watt Memorial Institute, Birmingham. 6 p.m.

I.E.E. (W. Utilisation Group). Chairman's address. "Developments in Electrical Plant for Industry," J. M. Ferguson. S. Wales Institute of Engineers, Park Pl, Cardiff. 6 p.m.

I.E.E. (Sheffield). Chairman's address. "Electrical Contracting in Commerce and Industry," E. J. Lilleker. Angel Hotel, Brigg. 7 p.m.

I.E.E. (N.W. Graduates and Students). "A.C. and D.C. Variable Speed Drives, E. Hall. Electrical Engineering Department, Manchester University. 7 p.m.

I.E.E. (London Graduates and Students). Chairman's address. "Southern Region, Kent Coast Electrification Scheme—Power Supply Apparatus," Savoy Pl, W.C.2. 6.30 p.m.

TUESDAY, 25 OCT.

I.E.E. (Measurement and Control Section). "Rapid Methods for Ascertaining Whether the Activity of a Weak Radioactive Sample Exceeds a Predetermined Level," E. H. Cooke-Yarborough and R. C. M. Barnes. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). "Safety in the Utilisation of Electricity," S. J. Emerson. Carlisle Technical College. 7 p.m.

I.E.E. (N.W. Supply Group). "Field Suppression of Turbo-alternators," J. R. H.U. A. Hunt, W. J. Joyce and D. H. Tompsett. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (S. Midlands Graduates and Students). "Stereophonic Sound," K. N. Hawke. Alfred Herbert Hall, Coventry. 7 p.m.

I.E.E. (N. Staffs Graduates and Students). Senior chairman's address, G. H. Gillam. Swan Hotel, Stafford. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY. "A New Method of Strip Speed Measurement Using Random Waveform Correlation," M. A. Butterfield, G. F. Bryant and J. Dowsing. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

A.S.E.E. (Portsmouth and District). "Safety in the Utilisation of Electricity," S. J. Emerson. H.M.S. Collingwood, Fareham. 7.30 p.m.

WEDNESDAY, 26 OCT.

I.E.E. (Electronics and Communications Section). Chairman's address. "Channelling—A Sketch," T. B. D. Teroni. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Western). "Electricity in the Manufacture of Hydrogen Peroxide," B. E. A. Vigers and R. O. Fletcher. Lostock Alkali Social Club, Lostock Gralam, nr. Knutsford. 6.30 p.m.

I.E.E. (S. Midlands). Discussion. "The Non-destructive Testing of Materials," College of Advanced Technology, Birmingham. 6 p.m.

I.E.E. (Rugby). "Water-turbine-driven Induction Generators," C. L. C. Allen. Rugby College of Technology and Arts. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS. Symposium on New Components until 27 Oct. School of Pharmacy, Brunswick Sq, W.C.1.

BRITISH INSTITUTION OF RADIO ENGINEERS. (W. Midlands). "Industrial Applications of Automatic Control Using Electronic Techniques," R. J. F. Howard. Department of Electrical Engineering, University of Birmingham, Edgbaston, Birmingham. 6.15 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Western). "Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," J. S. Shaylor. School of Management Studies, Un'ty St, Bristol. 7 p.m.

I.E.S. (Leicester). "Light Sources and Their Applications," H. R. Ruff. A.E.I. Lamp and Lighting Co., Melton Rd. 6.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Wales). "The Automatic Control of Rolling Mills," W. N. Jenkins. Lecture Theatre of the Steel Co. of Wales Ltd., Port Talbot. 5.30 p.m.

THURSDAY, 27 OCT.

I.E.E. "The Principles and Operation of Large Radio Telescopes," A. Hewish. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S. Midlands). "Some Aspects of Engineering in Polar Regions," D. L. Pratt. Midland Institute, Birmingham. 6.30 p.m.

I.E.E. (Southern Graduates and Students). "Gramophone Pickups for Stereo and Mono

Reproducers," D. J. Edwards. Technical College, Brighton. 6.30 p.m.

I.E.E. (N. Scotland). Sub-centre chairman's address, L. F. Dorward. Electrical Engineering Department, Queens College, Dundee. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Analogue Computers," W. E. Willison. Lecture Theatre, Administrative Building, The Associated Ethyl Co. Ltd., Oil Sites Rd, Ellesmere Rd, Wirral. 7 p.m.

A.S.E.E. (E. and W. Kent). Dinner. Swan Hotel, Maidstone.

A.S.E.E. (S. London). "Industrial Applications of Isotopes," T. B. Rowly. Greyhound Hotel, High St, Croydon. 8 p.m.

A.S.E.E. (N. Ireland). "Protection Equipment for Industrial Plant," Dr W. L. Stern. Central Hall, Rosemary St, Belfast.

A.S.E.E. (Oxford and Districts). "Interference Suppression in Industrial and Research Establishments," A. C. F. Leadbitter. Reactor School, Harwell. 5.45 p.m.

FRIDAY, 28 OCT.

I.E.E. (N. Scotland). Sub-centre chairman's address, L. F. Dorward. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scotland). "Instrumentation of a Steel Strip Mill," H. G. Building Centre, Sauchiehall St, Glasgow. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chesham). "The Atomic Clock," L. Essex. Belle Vue Hotel. 7.30 p.m.

A.S.E.E. (Coventry and District). "Technical Education for the Electrical Engineer," M. M. Robins. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy Lane. 8 p.m.

SATURDAY, 29 OCT.

A.S.E.E. (Bradford and District). Dinner, Gt. Northern Hotel, Bridge St. 7.30 p.m.

MONDAY, 31 OCT.

I.E.E. (E. Anglia). "Modern Coal-fired Power Stations," A. E. Hawkins. Assembly Hse, Norwich. 7.30 p.m.

I.E.E. (Mersey and N. Wales). "The Application of Irradiation in Industry," M. C. Crowley-Milling. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). "New Amplifying Techniques," Prof C. W. Oatley. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (Malvern Group). A.G.M. and "Applications of Microwaves," Prof A. L. Collen. Winter Gdns, Gt. Malvern. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Applied Mechanics and Lubrication Groups). Discussion: "Roller Bearing Problems—Is There a Need for Fundamental Research?" Birdcage Walk, S.W.1. 6 p.m.

I.E.S. (Leeds). "Ship Lighting—Perils and Prospects for the Lighting Engineer," J. T. Grundy and G. H. Vaughan. Institute of Technology, Bradford. 7 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Bobrich (G.B.) Co. Ltd. Domestic, industrial and labour-saving electrical appliances, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: C. W. Good and C. T. S. Belk, 66 Queen St, E.C.4.

M. Boulter Ltd., 346a Humberstone Rd, Leicester. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: Maurice Boulter and Mrs Elsie V. Boulter.

P. J. Bullen Ltd. Electrical engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subscribers. Subs.: Alexander S. M. Hetherington, Coteswood, Mayford, Woking; and Peter J. Bullen, 11 Russell Rd, Horsell, Woking.

Castell Locks Ltd., Kingsbury Wks, Kingsbury Rd, N.W.9. To acquire the goodwill and certain of the assets of Castell Locks Ltd. (in liquidation), to carry on business as manufacturers of and factors of locks, etc. Nom. cap.: £10,000. Dirs.: Denis P. Castell, Annie L. Castell, Margaret E. Harries and David G. Roberts.

Dowty Technical Developments Ltd. Designers, developers, manufacturers and contractors for and repairers of and dealers in equipment, apparatus, plant and machinery, etc. Power is also taken to carry on business as manufacturers of and dealers in plastics and plastic materials, etc. Nom. cap.: £10,000. Dirs.: not named. Subs.: Michael J. Cansdale, Saddlers Hall, Gutter La, E.C.2; and Anthony H. Isaacs.

G.E.C.-Simon Carves Atomic Energy Co. Ltd. Nom. cap.: £50,000. Dirs.: to be appointed by subs. Subs.: Richard B. Catlow, 62 London Wall, E.C.2; and Philip M. Bevan-Thames, 20 Copthall Ave, E.C.2.

Roband Valve Co. Ltd., 55-56 Lincoln's Inn Fields, W.C.2. Manufacturers of and dealers in electrical, radio, television, mechanical and engineering components, etc. Nom. cap.: £100. Dirs.: Bernard S. Gold and Mrs Ellen Robinson.

Universal Electric Motor Co. (Enfield) Ltd., 2 Constance Rd, Enfield. Nom. cap.: £1,000. Permanent dirs.: Richard C. Hull, Victor H. Hull, Alice C. Hull and Richard C. Hull.

Heath-King 4th

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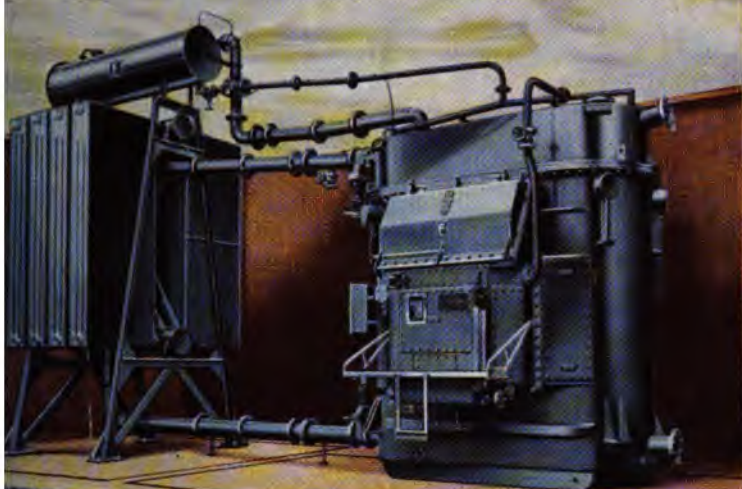
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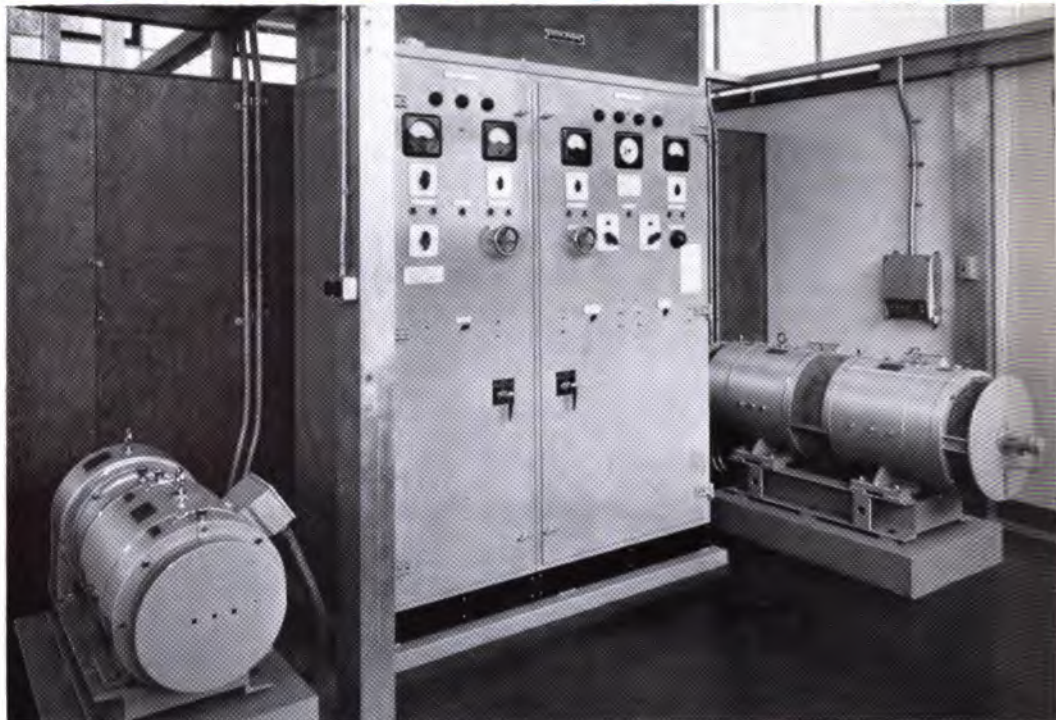


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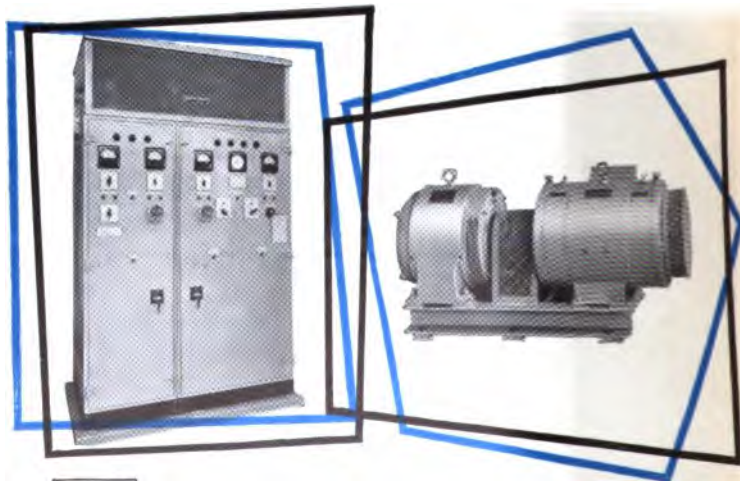


Electrical equipment destined for Canada is tested in Gt. Britain by the British Standards Institution on behalf of the Canadian Standards Association using E.D.C.C. equipment. This is a further example of custom-built special purpose equipment by E.D.C.C.

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Dynamometers	HF alternators
Rotary convertors	Voltage stabilisers
Flame-proof marine motors	Rotary transformers
Frequency changers	Battery traction motors
Induction regulators	D.C. generators
Single and Polyphase alternators	Magnetic couplings
	Control gear, etc.



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Dans ce numéro

Essais synthétiques des fusibles 629
Un circuit d'inductance—capacitance peut être employé pour vérifier le rendement de court circuit de fusibles. Il est un peu plus difficile à ajuster que l'est un alternateur, ne donne pas de courants asymétriques et manque de donner une récupération complète de voltage une fois que le fusible ait opéré. D'autre part, l'installation, l'opération et le maintien en sont beaucoup moins coûteux que dans le cas d'un alternateur. Il est pratiquement l'équivalent de cet alternateur lorsqu'il est question d'effectuer des essais de fusibles qui opèrent rapidement avec un courant cut-off et une libération d'énergie réduits.

Le Cuivre pour Matériel Electrique 633
Les propriétés du cuivre comme conducteur d'électricité sont en bonne harmonie avec les développements qu'il est possible de prévoir pour les projets de la technique électrique. Pour les transformateurs, l'usage de feuillards d'acier laminé à froid a réduit de beaucoup la quantité de cuivre employé pour un pourcentage donné de perte de cuivre. Des conducteurs de cuivre refroidis intérieurement dans de gros alternateurs n'ont révélé aucun ennui de corrosion. Le cuivre est plein de promesses en ce qui concerne l'opération d'une température tout près du zéro absolu.

Contrôle pour Laminaires d'Aluminium—2ième Partie 635
Les amplificateurs magnétiques sont très couramment utilisés pour le matériel de contrôle automatique pour un laminoir réversible chaud pour le laminage de lingots d'aluminium. Le laminoir est actionné par deux moteurs de 4,000 C.V. chacun, courant direct, fourni par un groupe Ilgner. Ce groupe est alimenté par un moteur à courant direct avec dispositif liquide de résistance dont la fonction est de limiter la charge du courant. La commande des tables principes est assurée par des moteurs à courant direct, par l'entremise de convertisseurs à arc au mercure, permettant aux moteurs de régénérer et d'inverser la sens de la marche.

In dieser Nummer

Kunstprüfung von Sicherungen 629
Sicherungen lassen sich auf ihre Kurzschlussleistung mit Hilfe eines induktiv-kapazitiven Stromkreises prüfen. Eine Anordnung dieser Art ist zwar nicht so leicht einzustellen wie ein Wechselstromgenerator, gibt keinen asymmetrischen Strom ab und kann u.U. dazu führen, dass die volle Spannung nach Betätigung der Sicherung nicht wiederkehrt. Andererseits aber ist sie billiger in der Anschaffung und Instandhaltung als ein Wechselstromerzeuger und ist diesem praktisch gleichwertig sofern es sich um die Prüfung von Sicherungen handelt, die schnell ansprechen und zwar mit niedriger Abschaltleistung unter Freigabe nur geringer Energiemengen.

Kupfer als Werkstoff beim Bau elektrischer Geräte 633
Als elektrisch leitender Werkstoff weist Kupfer Eigenschaften auf, die den Bedürfnissen der voraussichtlichen Entwicklungen auf elektrotechnischem Gebiet entgegenkommen. Im Transformatorenbau z.B. führt die Verwendung kaltgewalzter Stahlbänder als Werkstoff für Kerne dazu, dass viel weniger Kupfer für einen gegebenen perzentualen Gleichstromverlust zur Anwendung gelangt. Im Bau grosser Wechselstromgeneratoren hat die Verwendung innengekühlter Kupferleiter zu keinerlei Korrosionserscheinungen geführt. Für den Bau elektrischer Geräte, die bei sehr tiefen Temperaturen in der Nähe des absoluten Nullpunktes arbeiten ist Kupfer besonders gut geeignet.

Steuerung eines Aluminium-Walzwerkes, II 635
Bei der Steuerung eines zum Heisswalzen von Aluminiumbarren eingesetzten Umkehrwalzwerks mit automatisiertem Betrieb werden weitgehend magnetische Verstärker verwendet. Das Walzwerk wird von zwei Gleichstrommotoren von je 4000 PS angetrieben, die durch einen Ilgner-Satz gespeist werden. Dieser wird von einem Wechselstrommotor angetrieben, dessen Leistungsaufnahme durch Flüssigkeitswiderstand begrenzt wird. Der Antrieb der Hauptrollgänge erfolgt durch Gleichstrommotore, die durch Quecksilberdampfgleichrichter gespeist werden, sodass sie sich zur Nutzbremsung und Umschaltung eignen.

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ELECTRICAL
TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
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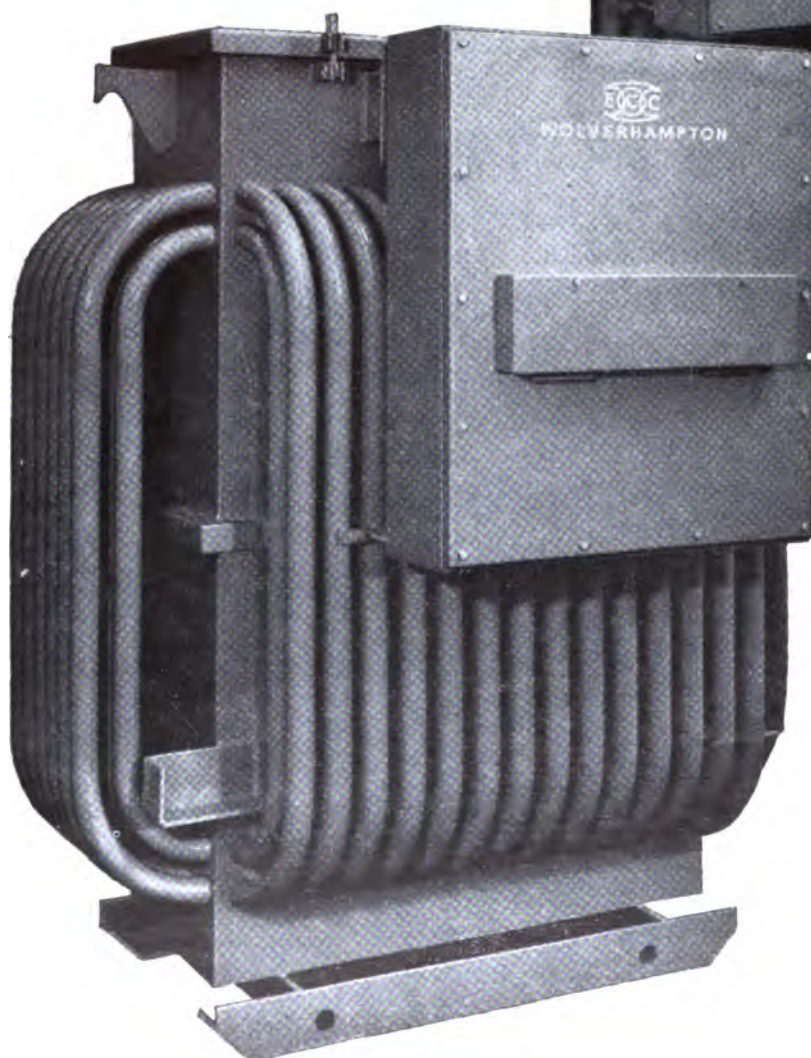
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COMBINED TRANSFORMER AND LT SWITCHGEAR UNITS



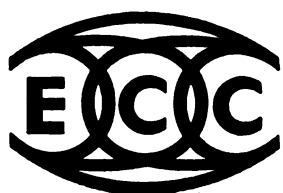
MOULDED CASE
CIRCUIT-BREAKERS

FOR USE WITH
ANY APPROPRIATE
TRANSFORMER

NO FLOOR
SPACE FOR
LT SWITCHGEAR

LOW INITIAL COST

SHORT CIRCUIT TESTED



WOLVERHAMPTON

ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 27 OCTOBER, 1960

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ment

INDUSTRY FORUM

By the end of this year, the Electrical Fair Trading Council will be dead, another casualty of the Restrictive Trade Practices Act. In its 24-year existence it has not only operated effectively as the guardian of orderly trading within the electrical industry, it has also provided common ground on which differing sections of the industry could meet. Within the next few weeks the question will be decided whether a new body should succeed EFTC as a forum for the industry. At present, manufacturers are on the whole against this idea; wholesalers and contractors for it. Urgency about a decision comes because the EFTC is unique as a whole-industry meeting point. It will be increasingly difficult to start a new representative organisation as memories of EFTC fade into the past. With all the uncertainties of trading that have been demonstrated over recent years, it seems to us wise to keep at hand some machinery for joint consultation and exchange of views between the different parts of the electrical industry. Sectional interests differ and must quite frequently clash, but there is superimposed a specifically "electrical" viewpoint which may need presenting to Government, to associations representing other trades and to various official bodies. Those who deprecate the idea of the new electrical forum point out truly enough that there will be little immediate business for it, and show some fear that it may come to make work for itself in the absence of finding some current task at hand. But it is to the unknown future that the idea of the forum looks, not to the immediate present with interlinking forces in the industry still at work. Individual trade associations who will be taking a decision on the forum idea in the next few weeks should at least agree to forming a committee to look more closely into the idea, rather than shy away because of its apparent difficulties and lack of immediate advantage.

ELECTRICAL EXPORTS AID

If export orders for heavy electrical plant are to be won, not only must the design be good and the price and delivery right, the credit terms offered to the customer must often be generous as well. That last detail has been a serious stumbling block in the face of continental competition backed by Government help for industry, for British financial institutions have stood firm against any suggestions that they should join in a credit race. Last week, however, some relaxation in one aspect of British practice was announced by the President of the Board of Trade. In future, the Export Credit Guarantee Department, the channel through which the Government backs British exporters, will be able to extend its cover for longer

than the five years maximum that has previously applied. The extension is hedged around with provisos, including the requirement that this shall only be done where contracts are commercially desirable, from a prestige or replacement market aspect, and where foreign competitors can be shown to have Government backing, too. It will apply on an exceptional basis, with each case to have separate consideration—a dangerous possibility of delay comes in here—but for all these shortcomings it will be welcomed by electrical manufacturers as an opportunity to compete more nearly on equal terms with continental manufacturers. They will welcome as well another change, whereby the ECGD arrangements can apply for the first five years of long-term credit in cases where exporters feel justified in carrying the risk for the extension period. ECGD rules have previously been too rigid to fit in with such an arrangement. In both cases, however, exporters are still left to find the finance. The extension of guarantees helps them do that; it does not ensure that they will succeed in the British market.

SYNTHETIC TESTING POSSIBILITIES

Full-power, short-circuit testing is a procedure so expensive in equipment that some cheaper way of obtaining the information it can give has long been sought. The principles that a substitute synthetic test have to satisfy are clearly enough defined. Fault current should be present at the magnitude which will be met by the gear under test when in use, and it has to be succeeded by a recovery voltage appropriate in magnitude and frequency characteristics. Although much progress has been made along these lines in the testing of circuit-breakers, there has been less attention to the synthetic testing of fuses. ERA work based on a Russian suggestion is described in our pages this week, and it has produced results which show that, at least for development work, synthetic testing using capacitors in an oscillatory circuit may have applications as an alternative to a short-circuit test alternator. However, for fuse work the synthetic testing in an oscillatory circuit cannot replace the full-power test in final proving. The mechanism of fuse operation, and especially sensitiveness to current asymmetry, does not fit in well with the possibilities of the synthetic test.

TALKING ABOUT I.E.E.

IEE members departed from their usual disinterest in the government of the Institution last year to produce a turbulent series of debates on alterations to the by-laws. Out of those events has come an honest attempt by the IEE Council to find what went wrong and how it could be set aright for the future. Last week, members received the report of the *ad hoc* committee which was charged by the Council with the task of looking into the contradictory mass of complaints and suggestions put forward during the by-laws debates. The IEE

membership owes a considerable debt of gratitude to this hard-working committee—it worked through no less than 14 whole-day meetings—for the outspokenness of its report. Independent engineers most closely in touch with the affairs of the Institution can endorse the overall judgment that there is nothing basically wrong with the working of the IEE but that something has happened over the years to sour relationships between Council and the general body of members. "Communications" is the fashionable word for the phase of business that was unsatisfactory. The report now before the IEE membership deserves to be thought about carefully if members want to build up the liveliness of the Institution. Now that expression of individual views (which was always welcome, but sometimes difficult to effect) is to be made easier, members need to recognise that they are being given responsibility as well as opportunity. Probably the greatest satisfaction the *ad hoc* committee would receive would be occasioned by a more active and vociferous membership developing. The Institution is a power in the land today. Increased active interest by members can increase that power and its effectiveness.

ULTIMATE IN METER READING

Close attention currently being given to reduction of meter reading costs inevitably raises the question: How far away is the ultimate of fully centralised reading? Even if it is accepted that the integrating meter will have to remain part of the equipment at the consumer's premises, there seems no absolute technological bar to recording its indication at a central accounts office. The bar, of course, is economic. This question has been discussed recently in *Edison Electric Institute Bulletin*, association journal of the US private enterprise supply companies. Some 40 patents for providing central meter reading have been filed in the US but none of these is the complete answer. The technique most likely to achieve success, it is suggested, is a telephone line method with special equipment that can effectively interrogate the consumer's meter and obtain either an absolute reading of its registration or a figure showing consumption since the last check. The US estimate is that such a technique is approaching the area of economic acceptability at present, at least as a long-term hedge against rising costs of meter reading by peripatetic employees; and with some 90% of domestic electricity consumers in the US connected to the telephone system, the special-purpose wire-running is likely to be small. In this country, a much smaller proportion of domestic premises are on the telephone, so on that count alone centralised reading must be further away. Yet it is a technique that should begin to receive attention, for it accords well with the tide of mechanisation coming into consumer billing, and offers the opportunity of obtaining more accurate information on consumers' load characteristics.

Meteor

This week's quick summary of electrical news faces advertisement page 8

Synthetic tests on fuse links

POSSIBILITIES OF USING AN OSCILLATION CIRCUIT

by H. W. Baxter,* B.Sc., M.I.E.E.

SYNTHETIC testing, by means of which the breaking capacity of a circuit-breaking device can be predicted from tests using a source of lower power than would otherwise be required, has been a subject of investigation for some years for the testing of certain types of circuit-breaker. It was suggested because the large amounts of power that would otherwise be required were tending to become prohibitive, but it is not yet generally adopted because full agreement has not been reached on the method. It offers financial advantages, since the equipment can be less costly than an alternator.

Synthetic testing has not hitherto been much used for the proving of fuses because power adequate for this has usually been available, but a circuit has been described by Kaplan and Nashatyr† which is claimed to be suitable for the testing of h.v. fuses and to have certain economic advantages. Preliminary comparative tests have been made using this circuit and the results are compared with those obtained using the 10,000 kVA alternator installed at the Electrical Research Association's laboratory.

Kaplan and Nashatyr Circuit

If the pre-arcing time of a fuse is short in comparison with the time of a half cycle, the conditions obtaining in a power-frequency circuit can be simulated in an oscillation circuit of higher frequency.

The rate of rise of a sinusoidal current is $I_{\max} \omega \cos \omega t$, which at time $t=0$ is $I_{\max} \omega$. If the oscillation circuit rate of rise of current is $I_{1\max} \omega_1$ and that in the power frequency circuit is $I_{2\max} \omega_2$ then, for the two rates of rise of current to be substantially the same, $I_{1\max} \omega_1 = I_{2\max} \omega_2$. The prospective current can thus be reduced as the frequency of the oscillation circuit is increased; but the frequency cannot be increased significantly unless the fuse melts rapidly, so that the current during the pre-arcing period is substantially the same as it would be in a 50 c/s circuit.

The circuit which, it is claimed, is suitable for testing a device with a large voltage drop, such as a fuse, is shown in Fig. 1. Two circuits are described which are said to be of equivalent "economic efficiency." The one in Fig. 1(a), with current division, is recommended when the capacitor is charged to the voltage rating (peak) of the fuse. The circuit in Fig. 1(b), with voltage division, requires fewer capacitors but charged to a higher voltage than the voltage rating of the fuse. The latter circuit is the one that was used for the comparative tests described in this article.

* This article is based on ERA report G/T321: "Comparative Tests of H.V. Fuse Links in an Oscillation Circuit and with an Alternator." Mr Baxter is with the Electrical Research Association.

† V. V. Kaplan and V. M. Nashatyr: "Testing of Current-Limiting H.V. Fuses in an Oscillation Circuit," *Elektrichestvo*, No. 5, 1956, pp. 38-42.

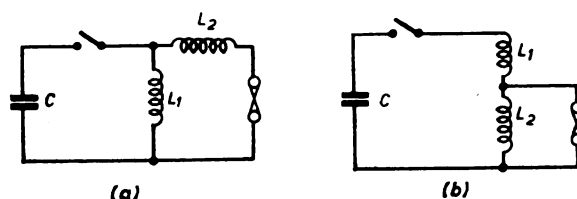


Fig. 1. Oscillation circuits for fuse testing

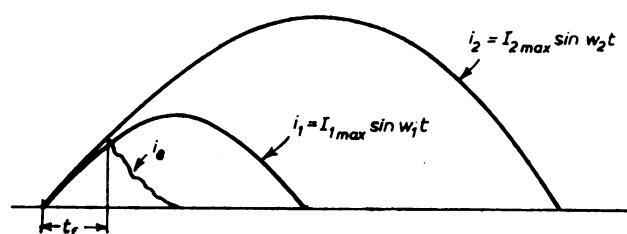


Fig. 2. Diagram illustrating approximate equivalence of pre-arcing currents in circuits of different frequencies and prospective currents when the pre-arcing time t_1 is short

The circuit consists of two inductors L_1 and L_2 in series, with the fuse to be tested connected across L_2 . When the circuit is connected to the charged capacitor C the frequency of oscillation is determined by the values of C and L_1 since L_2 is short-circuited by the fuse. When the fuse element has disrupted, L_1 and L_2 are in series and the frequency of the circuit is then lower and can be made equal to the normal power frequency of 50 c/s. The power-frequency current that would be applied to the fuse in a conventional test is represented by i_2 in Fig. 2. The higher-frequency current is represented by i_1 and in this instance it is shown as of twice the frequency and half the amplitude of i_2 , so that the initial rate of rise of current after a current zero is identical in each case; i_1 represents an oscillogram of a fuse with significant cut-off and if the pre-arcing time t_1 is sufficiently short the two currents i_1 and i_2 may be considered as practically equivalent. When the element has disrupted, the voltage applied to it is that appearing across L_2 . If the components are suitably chosen this can be of normal power frequency (50 c/s) and of magnitude equal to the voltage rating of the fuse.

Test Results

Comparative tests were made using commercial 6.6 kV potential transformer fuse links of $\frac{1}{2}$ A nominal rating. Three were tested in the alternator circuit shown in Fig. 3(a) and three were tested in the oscillation circuit of Fig. 3(b).

The alternator circuit was adjusted to give a prospective symmetrical current of 1,000 A r.m.s. at a power factor of approximately 0.1. This gave an initial rate of rise of current of 443,000 A/sec.

The initial frequency of the oscillation circuit was approximately 85 c/s and the initial rate of rise of current

with the capacitor charged to 14.6 kV was $14.6/32 \times 10^6$ or 450,000 A/sec. The prospective current in the capacitor circuit was approximately 600 A r.m.s. and the energy stored in the capacitors was about 12,000 joules. This corresponds to a charge of 1.66 coulombs.

The final frequency, with L_1 and L_2 in series, was approximately 50 c/s and the peak voltage across L_2 if negligible energy were taken from the capacitor would be $64 \times 14.6/(32+64)$ or 9.7 kV (6.8 kV r.m.s.). The oscillation circuit thus simulates the alternator circuit provided that the pre-arcing time is short and that a negligible amount of energy is taken from the capacitor during the operation of the fuse.

Representative oscillograms of fuse links that operated satisfactorily are shown in Fig. 4. There were small variations in repeat tests, but the oscillograms did not depart seriously from those shown. It will be seen that comparable results were obtained in the two circuits. The arc energy tended to be slightly lower in the oscillation circuit and the recovery voltage was also lower (about 15% to 20% lower), owing to the energy taken from the capacitor, which was about 2 kW sec. On the other hand, the voltage across the fuse at current extinction, appeared to be higher in the oscillation circuit, an average of about 3.5 kV as compared with 1.3 kV in the alternator circuit. The pre-arcing time under these conditions was less than 0.5 msec and the cut-off current was about 100 A. The arcing time was about ten times the pre-arcing time.

Comparative tests were also made using fuses that failed in the alternator circuit to see if they would also fail in the oscillation circuit. The cartridges were of the same physical dimensions as those used in the earlier tests, but the length of the element was reduced.

The oscillogram of the fuse link tested in the alternator circuit* is shown in Fig. 5 (a). There was insignificant current-limiting effect, practically the full value of the prospective current being reached and the circuit was cleared by the back-up circuit-breaker. The fuse link shattered.

Four fuse links were then tested in the oscillation circuit.† Two arced for one half cycle and liberated about 5 kW sec of arc energy. In the remaining two tests arcing lasted for two half cycles and the arc energy reached approximately 12 kW sec. Arcing could not persist because the capacitor was practically discharged. There was no violent shattering, as in the tests with the alternator, but the cartridge of one of the fuse links cracked. Typical oscillograms are shown in Figs. 5 (b) and (c).

Reduced Prospective Current Test

BS 88:1952 (Electric fuses for voltages up to 660 V) and BS 2692:1956 (fuses for a.c. circuits above 660 V) specify a test under conditions of maximum inductive energy, the prospective current for which may have to be below the maximum breaking capacity. The conditions for this test are such that the pre-arcing time is almost a quarter cycle, and there may be virtually no cut-off. Such a test cannot, therefore, be simulated in the oscillation circuit, because of the serious departure from linearity of the rise of current.

A simple series arrangement of inductance and capacitance can be used to obtain a 50 c/s current, but the stored energy would be small. For the fuse links tested, the maximum inductive energy corresponds to a prospective current of about 30 A. At 6.6 kV the circuit impedance

would be about 200 ohms ($L=0.6H$) and the capacitance to tune to 50 c/s about 15 μF . The stored energy at $\sqrt{2} \times 6.6$ kV is roughly 0.75 kW sec, the corresponding charge being 0.15 joules. The energy liberated in the fuse link during the first half cycle would probably be about one half the initial energy in the capacitor; the recovery voltage would, therefore, probably be so small as to invalidate the test.

Since the reduced-prospective-current test requires less power the advantage of the oscillation circuit is not then so great.

Interpretation of Results

Since the energy available is small compared with that obtainable from an alternator, failure of a fuse to interrupt the oscillation circuit may not be accompanied by explosive violence. Some other criterion of failure is, therefore, necessary.

In a well-designed fuse the cut-off current is not exceeded and, in fact, the current thereafter is usually less than the cut-off value. If the current continues to increase after cut-off, as in Figs. 5 (b) and (c), the fuse may be considered to have failed, and it would probably be destroyed if tested in a power circuit.

A reduction of the current after cut-off, as in Fig. 4(a), might be regarded as a successful clearance, more especially if the arc extinguishes at the first current zero, provided that the recovery voltage is not seriously reduced. In this particular test the recovery voltage was 5.1 kV, a reduction of nearly 23% from the nominal value of 6.6 kV. The required value could be obtained by re-calculating the circuit, but this would increase the voltage during arcing and so increase the arc energy beyond what it would be in the alternator circuit. When the arc duration is short and the pre-arcing energy small, it is unlikely that any major modification to the oscillation circuit would be required.

Advantages and Drawbacks

The main attraction of the oscillation circuit is its simplicity and low cost. The capacitors used in these tests cost about £1,000. The cost of the charging equipment depends on the charging rate but would probably not exceed £250. A machine of, say, 10% reactance to give the equivalent prospective current (1,000 A) would be of about 1,000 kVA capacity, and with its driving motor and associated equipment would cost several thousand pounds.

The maintenance and running costs of the oscillation circuit are smaller than those of an alternator. Against this must be set the fact that its scope is more limited, since it is confined to tests in which melting occurs in a small fraction of a half cycle and in which the arc energy is small in comparison with the initial energy in the capacitor.

The main technical drawbacks of the oscillation circuit are:

1. It is more troublesome to adjust than an alternator circuit because C , L_1 , L_2 and V_0 must be correctly chosen to give the desired rate of rise of current and recovery voltage. Allowance may also have to be made for the loss of charge from the capacitor during the operation of the fuse.
2. It furnishes a symmetrical current. The effects of current asymmetry could probably be simulated, although this is an additional complication.
3. The liberation of a large amount of arc energy may discharge the capacitor to such an extent as seriously to reduce the recovery voltage.

* Only Duddell oscillographs were available for these tests.

† The voltage rating is 15 kV (d.c.), intermittent operation.

Conclusions

- The main conclusions are:
- 1. The oscillation circuit is practically equivalent to an alternator circuit when testing fuses that operate quickly with a small cut-off current and small liberation of energy and it could probably be usefully employed as a substitute for an alternator during the development stage.
 - 2. The energy available from the oscillation circuit is small in comparison with that available from an alternator. A large liberation of arc energy may, therefore, cause a significant reduction of recovery voltage.
 - 3. Asymmetrical currents cannot be obtained with an oscillation circuit.
 - 4. The reduced-prospective-current test corresponding to maximum inductive-energy cannot be simulated in the oscillation circuit because of the long pre-arcing time and departure from linearity of the rise of current.
 - 5. The oscillation circuit is cheaper to install, run and maintain than an alternator, but has a smaller power output and cannot be regarded as a substitute for an alternator for all breaking-capacity proving tests.

APPENDIX

Calculation of values of C, L₁, L₂ and V_c (Fig. 1 (b)).

f₁ = initial frequency.
f₂ = frequency of recovery voltage (50 c/s).
V_c = voltage to which C is charged.
V_f = voltage (r.m.s.) rating of fuse.
I = prospective current (r.m.s) at frequency f₁.

$$\frac{\sqrt{2} V_f}{V_c} = \frac{L_2}{L_1 + L_2} \dots \dots \dots (1)$$
$$\left(\frac{\omega_1}{\omega_2}\right)^2 = \frac{L_1 + L_2}{L_1} = \gamma^2 \dots \dots \dots (2)$$
$$\frac{V_c}{L_1} = \frac{di}{dt} = \sqrt{2} \omega_2 I \dots \dots \dots (3)$$
$$\omega_1 = \frac{1}{\sqrt{C(L_1 + L_2)}} \dots \dots \dots (4)$$

From which

$$C = \frac{I (\gamma^2 - 1)}{\omega_1 V_f \gamma^4}$$
$$L_1 = \frac{V_f \gamma^2}{\omega_2 I (\gamma^2 - 1)}$$
$$L_2 = \frac{V_f \gamma^2}{\omega_1 I}$$
$$V_c = \frac{\sqrt{2} V_f \gamma^2}{\gamma^2 - 1}$$

Choice of ω₁—Considering first a 50 c/s current of I amperes r.m.s prospective value, the initial rate of rise di/dt is 314 √2 I. If the pre-arcing time of the fuse were 1 msec the cut-off current would be 0.309 √2 I. If the current rose linearly at the rate of 314 √2 I A/sec the value after 1 msec would be 0.314 √2 I. The difference, being less than 2%, is insignificant. It, therefore, seems that the pre-arcing should preferably not exceed one msec if an oscillation circuit is to be used. In general, the frequency f₁ should not be higher than:

$$\frac{50 \times 0.309 \sqrt{2} \text{ prospective } 50 \text{ c/s r.m.s. current}}{\text{cut-off current}}$$

or say :

$$22 I/(\text{cut-off current})$$

In setting the oscillation circuit it is essential to know the cut-off current at the chosen 50 c/s prospective current. This can be calculated from information given in ERA report Ref. G/T246.†

The appropriate frequency ω₁ may then be determined, after which the values of L₁, L₂, C and V_c may be calculated.

† Calculated Curves of Inductive Energy at the Start of Arcing in Fuses. By H. W. Baxter.

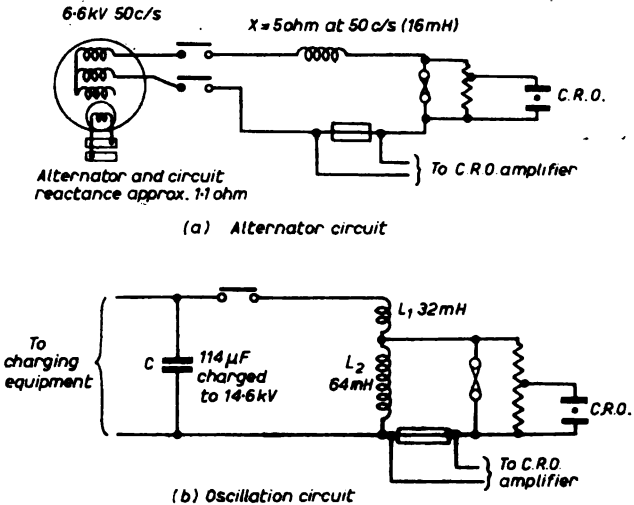


Fig. 3. Constants of (a) alternator circuits, and (b) oscillation circuit used in tests

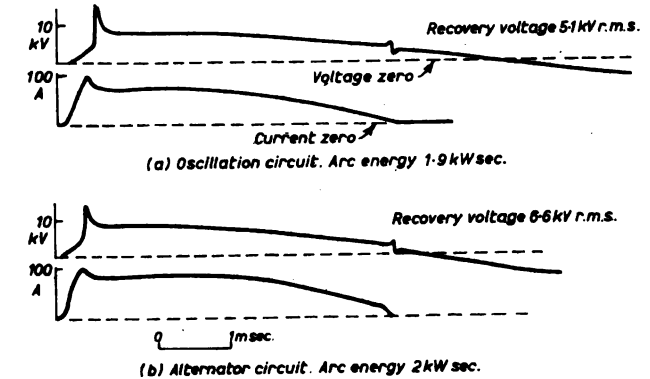


Fig. 4. Representative oscillograms taken in circuits (a) and (b) of Fig. 3

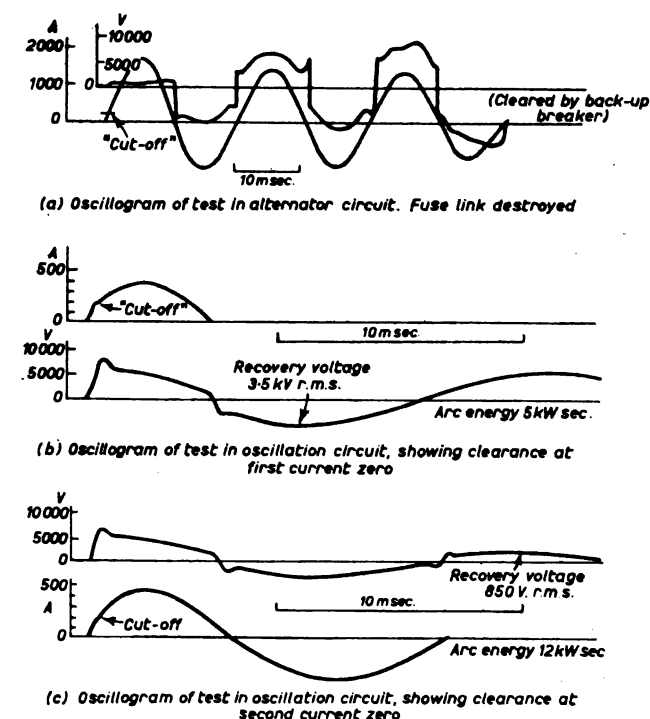


Fig. 5. Results of various tests

CONSENT FOR OLDBURY

MINISTERIAL consent for construction of the CEGB's 550 MW nuclear power station at Oldbury-on-Severn, Gloucestershire, was announced last week. The site lies on the south-east bank of the Severn Estuary, 14 miles north of Bristol and 4½ miles downstream from Berkeley power station. The new station is programmed for completion in 1966, and the official CEGB view is that this target date will still be possible "despite the long delay in obtaining consent." Application for the consent was made to the Minister in April, 1959, but it was not until April, 1960, that a public inquiry was held.

Ministry of Power and Ministry of Housing and Local Government inspectors who conducted the public inquiry concluded that, although construction of a power station at Oldbury would inevitably do damage to an attractive landscape, the loss would not be grave enough to justify refusing or deferring consent to the station. Both inspectors concluded that the technical advantages of the site outweighed the loss of agricultural land. However, the MoH and LG inspector added that he found a possible multiplication of power stations on this section of the Severn disturbing. The Minister of Housing has indicated that he is considering the general position in the Severn Estuary "in the light of future industrial needs, including the possibility that the CEGB may wish to develop the other sites now under investigation, in order to guard against the risk of haphazard developments in this area."

Technical Features

Technical features of the Oldbury site and the nuclear station planned for it are set out in the inspectors' report, made available to interested parties. Oldbury is considered strategically placed to meet loads in central southern England, which is the most difficult to supply economically

of the whole CEGB area. A station there would help supply the growing demands of Bristol and its suburbs, and meet the night loads in South Wales, which are considerably above the national average because of the heavy concentration of industry.

Cooling water supplies at Oldbury are virtually unlimited, except at the lowest part of the tidal range. Advantage is to be taken of a rock shelf off-shore to create an artificial tidal reservoir, from which cooling water can be drawn at low tide periods. (Ministry of Transport consent for this is promised.) The reservoir will be 350 acres in extent. Cooling water requirements for a 550 MW station are estimated at 30 million gallons/hour. Foundation conditions at Oldbury are good, and it is anticipated that the station can be built using a comparatively simple and relatively cheap form of raft foundation.

1,550 MW Future?

Although a 550 MW station is the subject of the consent, the Board is anticipating a second station, possibly of 1,000 MW capacity, at a later date. This second station might be a more advanced design than the first, which will be of the gas-cooled graphite-moderated natural-uranium fuel type. The initial station will have two reactors, a turbine house and a switch house.

Transmission from Oldbury will be over the existing Melksham-Uskmouth 275 kV double circuit line which will be looped into the station switchgear; and by a new 275 kV double circuit line running south from the station to connect into the grid system in the Bristol direction. No new lines will run north from Oldbury.

Oldbury is the seventh nuclear station for which the CEGB have received assent. Tenders for construction of the sixth station, at Sizewell, are currently being examined.

Columbia River project to go ahead

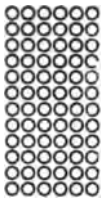
THE simultaneous announcement in Washington and Ottawa that agreement has been reached between Canada and the US for the co-operative development of the Columbia River marks yet one more stage in a project which may rival the St. Lawrence Seaway before it is complete. The scheme to harness the waters of the Columbia and Kootenay, together with their lakes, on Canadian territory for the mutual benefit of both countries has long been discussed and, indeed, in Columbia has been considered of such significance as to merit inclusion in discussion groups of the schools from Grade 5 upwards. Some of the points have given rise to acrimony, for Canada is jealous of its rights in Columbian River waters and there has been the point of view that all of the current generated in the Canadian territory should be used for Canada and not exported. Engineers from both countries have taken a more liberal view and have co-operated wholeheartedly in surveying the areas and have presented, through the International Columbia River Engineering Board, three plans, each incorporating a number of dams, with estimates of costs for the consideration of the International Joint Commission.

The first of these is for 11 dams at Libby and Kootenay Falls in the US on the Kootenay River, Bull River junc-

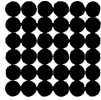
tion, Mica, Downie Creek, Revelstoke Canyon, Dunca Lake, High Arrow, Murphy Creek, Low Arrow and Kootenay in Canada. The second includes a dam at Copper Creek and diversion of the waters of Kootenay to the Columbia, which are only a mile apart at this point. The third is for a dam at Dorr, forcing the flow of the Kootenay back into Kootenay Lake. There is no indication which of the plans has been adopted but the mention of the initial sums involved, \$450 million, would seem to indicate that this is for the construction of a dam at High Arrow and, possibly, Mica, by Canadian engineers while the US is believed to have been granted permission to go ahead with the Libby dam in Montana.

The total cost of the schemes was estimated, at 1955 levels, to range from \$3,560 million to \$3,880 million. Even at this stage there is some uncertainty as to how these large sums will be raised but, such is the prestige of hydro-electric projects these days, a way is sure to be found, particularly since the projects are estimated to boost power output from the Columbia by 9,000 MW.

Meanwhile, it would appear to many that the alternative scheme for harnessing the Peace River has been shelved, at least for the present.



Outlook for copper



ELECTRICAL FUTURE SEEMS ASSURED

USE of copper in the heavy electrical industry may reasonably be expected to increase, commensurate with the expansion of production to be anticipated in the future. Only a drastic, and at present unpredictable, change in the price of copper or its rival materials is likely to alter this conclusion. Copper remains in many respects the most suitable material for large electrical machines and its convenience for electro deposition is one reason for its importance to the electronics industry because it enables the intricately shaped and accurately dimensioned radar components to be constructed.

These conclusions sum up the symposium on recent developments in the use of copper for the electrical industry held at the Dorchester Hotel last week under the chairmanship of the Earl of Verulam, managing director of Enfield Rolling Mills.

The four papers discussed dealt with the economic use of copper in large transformers, internally cooled copper conductors, copper as a material for waveguide construction and some applications of copper alloys.

Transformer Economics

The economic use of copper in power transformers was outlined by Mr F. W. Gee (Ferranti). His paper was concerned with predicting probable consumption of copper in the next ten years on the basis of past trends. Although, in comparing different designs of a given transformer, the aim must always be to find the design giving the lowest cost, criteria must be selected to take into account other major factors such as the permissible losses. A useful guide was to plot the ratio of kVA per lb of copper to percentage full load loss, against the transformer MVA rating. Such a graph revealed the importance of the cold rolled steels used in recent years for reducing the amount of active copper. For example, utilisation of copper had increased by 20% for a 40 MVA transformer, while for a 100 MVA unit it had risen 40%.

Stray losses, which might amount to 25% of the direct load losses and might sometimes even exceed direct I²R losses could be reduced by using continuously transposed, stranded conductors. Such conductors, which were stranded on a special machine, might have as many as 27 lightly insulated strands in parallel. This technique could reduce the stray loss by 10 to 20%. Use of super purity copper in very strong leakage fields might result in an increase in stray losses. This objection could be overcome by using higher resistance alloy coppers which also had the advantage of higher tensile strength to meet the considerable mechanical forces which may occur in large transformers.

Marginal improvements might be attained with new insulating materials and for small transformers, foil windings had possibilities since they had only the volts per turn between layers and the series capacitance was high, giving a linear surge voltage distribution. However, the limitations are likely to be in the foil dimensions and in reliability of insulation.

Copper consumption for transformers was likely to have

risen by 40% to 50% by 1970 given certain assumptions, of which the most important were that no further radical improvement in core material could be expected and that there would be no major changes in the prices of either copper or core steel.

Cooling Conductors

In the second paper, Messrs Cogle, Hartill and Tudge (AEI Ltd., Manchester) outlined some applications of liquid-cooled conductors to such diverse products as turbo-alternators and thermo-nuclear devices.

Conductor cooling by liquid and gas had enabled the weight of active material and floor space requirements of turbo-alternators to be reduced to about 30% of machines built 12 years ago. Mr Tudge referred to the Bold 30 MVA turbo-alternator which had been in service since 1956. The machine had a stator winding, cooled by circulation of turbine condensate through hollow copper conductors. The rectangular conductors were drawn from electrolytic copper tube to close tolerances and then formed into transposed windings. Special hydraulic joints were developed to prevent leakage, using p.t.f.e. links for the water circuit. Rotors in use were cooled by hydrogen, circulated either by fans or by scoops arranged along the rotor length. Here also close tolerances were necessary on the conductors and use of a 0.07% silver copper had assisted in preventing winding deformation in use.

Water cooling has also been used for turbo-alternator terminals and links to the windings. The authors suggested that the next logical step would be to water cool connections between the alternator and generator transformer.

Two applications of water cooling for transformers were described in the paper. Both were welding transformers, with single-turn secondaries, one operating at 50 c/s and the other rated 230 kVA 450/42 V 10 kc/s. Water, circulated through hollow primary windings, also removed heat from the closely positioned secondary sheet conductor. Conventional power transformers were unsuitable for water cooling in the authors' opinion because the long length of conductor required prohibitively high water pressures to ensure adequate circulation. However, provided copper hollow conductors could be manufactured in sufficiently long lengths, water cooling was feasible for generator transformer windings rated 11 kV and below.

The paper also described use of water cooled conductors for the Glasgow synchrotron and other research applications and concluded by referring to the future possibility of cooling by liquid gases. At the low temperatures of such gases as hydrogen and helium, the superconductive properties of copper would permit greater power output per unit weight.

The paper by Messrs Hall and Meggs (AEI Ltd., Leicester) dealt with uses of copper for manufacturing radar waveguides. The authors outlined the electroforming process for producing accurately dimensioned components and referred to some of the inherent difficulties of the process.

Copper Alloys

In the final paper, Mr T. L. Richards (CDA) outlined some of the properties of copper and copper alloys available for use by the electrical industry. Annual requirements of the British electrical industry were about 300,000 tons, mostly in the form of high conductivity copper.

The three grades of high conductivity copper available had only minor differences in their principal mechanical properties and electrical conductivity. Certain of their mechanical properties, however, rendered them suitable for particular applications. Electrolytic-coppers were preferred for enamel wires because they tended to soften more readily at elevated temperatures after work hardening than fire-refined coppers. This enabled annealing of wires to be performed at the same time as enamelling. On the other hand, fire-refined copper had greater resistance to softening during soldering and it was, therefore, often preferred by commutator manufacturers. The third grade, oxygen-free copper, was imported from the USA. Its freedom from embrittlement after brazing was an advantage for the construction of rotors for squirrel-cage induction motors. It was also widely used in the electronic valve industry.

Of the many alloys available, an alloy with addition of 0.08% silver raised the softening temperature by between 100°C and 150°C, an advantage for commutator construction. Its use had also eliminated rotor failures due to copper shortening on turbo-alternators. Cadmium copper, with about 1% cadmium, had similar resistance to softening as silver copper and its high resistance to wear suited it particularly for overhead line equipment on power systems or railways' catenaries.

Chromium copper had been used for end rings and rotor bars on squirrel-cage rotors operating under severe stress at high temperatures. For switchgear parts and contacts it had the advantages that strength was improved by cold-working, while prolonged exposure at temperatures up to 350°C had little effect on its mechanical properties. A new alloy developed as a commutator material for aircraft equipment was zirconium copper. This was an age-hardenable alloy with properties similar to chromium copper but with the advantage of having its mechanical strength much less influenced by the direction of rolling. It was also appreciably stronger when notched like commutator segments.

Discussion

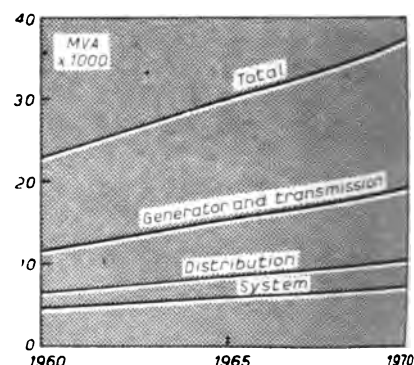
Presentation of the papers was followed by a lively discussion centred around transformers and the problems of electro-forming. The very high accuracy and surface finish essential for the internal surfaces of wave-guides had required development of electro-plating techniques which were considerably more refined than had been previously necessary.

In opening the discussion, Mr M. Waters (ERA) referred to a current programme of research into the properties of copper being undertaken by ERA. It was surprising how little was known about the mechanical properties of copper. It now seemed that differences in performance of transformers under hoop stress was due to the amount of initial cold-working the copper received during winding rather than to the presence of impurities. A paper presented at the 1960 CIGRE by Christoffel suggested that the strength of copper was maintained under sudden mechanical stresses such as occur on short-circuit. However, tests at ERA implied that his conclusions could have resulted from a different work-hardening history of the specimens tested. It had also been shown, by examining windings of a transformer which had been

in service for a number of years, that, contrary to the usual opinion, copper did not soften in service.

Referring to the effects of cold-working, Mr E. C. Mantle (British Non-Ferrous Metals Association) said tests had shown no evidence of softening after 12 to 18 months at 150°C with a 3% to 5% cold-worked copper. Cycling tests made to simulate short-circuit conditions in transformers had also shown no evidence of softening. Typical tests consisted of raising the specimen temperature to 250° for ten seconds, allowing it to cool to 150°C for five minutes and repeating for ten or more cycles.

Fig. 1. Estimated growth of the transformer market over the next ten years



The question of corrosion in water-cooled systems was raised by Mr P. McKenna (BICC) who referred to trouble experienced with furnace connections owing to the water supply being interrupted when the furnace was shut down. The solution seemed to be either to maintain water flow or to thoroughly flush out the system. He asked if trouble had been experienced with corrosion in the turbo-alternator installation referred to in the paper.

In reply, Mr Hartill said no evidence of corrosion had been obtained on the Bold machine, but it should be borne in mind that the water was of very high purity. In the case of the Glasgow synchrotron there was evidence of some deposit, but it was not attributable to copper corrosion. Cables in the synchrotron consisted of stranded enamelled conductors wound on a copper tube through which flowed water from the town supply. No recirculation was provided.

The subject of corrosion was also pursued by Mr D. E. Bird (Ewbank and Ptrs) who asked if special means had been taken to remove dissolved oxygen from the turbo alternator cooling supply. Again, Mr Hartill reported that no special precautions had been necessary. He did add however, that if Hydrazine, Morpholine or similar chemicals were added in the water treatment plant, they would have to be removed by a demineraliser before circulation through the copper conductors to avoid corrosion.

Mr S. A. Clarke (CEGB Southern Project Group) asked why it was not possible to mount the generator transformer much closer to the alternator and so reduce the length of linking busbar.

Some information on the properties of zirconium copper particularly for aircraft commutators, was given by Mr R. W. Shapton (Rotax). He said that zirconium copper was the nearest approach to the ideal commutator material yet produced and it seemed likely that its use for commutators would eventually become standard. Zirconium copper was better than chromium copper for temperature above 200°C, and its creep resistance was very much better than either chromium or silver copper.

The proceedings of the symposium are to be published by the Copper Development Association.

Hot reversing mill for aluminium—part 2

by D. W. Prowse,* B.Sc., A.M.I.E.E.

As indicated in the previous article*, AEI were contracted to supply the whole of the electrical equipment for the new four-high hot reversing mill Alcan Industries Ltd. (formerly Northern Aluminium Ltd.), at their Rogerstone Works.

The electrical equipment was designed to drive and control all operations on the ingot from leaving the ingot cast furnaces, through the rolling process, to the shear where the piece is cut up to the required length. It is then passed on to the 96 in. mill for further rolling and is either removed as a completed plate.

In this extensive installation AEI were able to achieve a large amount of standardisation.

Among the many advantages of standardisation two important ones are:

Reduction in the number of different components with consequent economy in the number of spares. Reduction in the number of different systems enabling the comprehensive scheme to be more readily understood by maintenance personnel.

For example, the a.c. auxiliaries were designed in close cooperation with the mechanical manufacturers Davy and Ward Engineering Co. Ltd. so that similar standardised components could be used for the electrical and mechanical control systems.

The d.c. control schemes and the closed loop regulators were designed so that the same magnestat pre-amplifier could be used throughout, with two sizes of second stage magnestats for the various types of control. The same magnestats were also used for the hot coiler controls for finishing mill.

The various drives are: main drive; feed rolls; main turntables; screwdowns; shear; roll change rig; side controls for mill side-guides, down tilter, etc.

Main Drive

Motor Control. The main mill drive consists of 4,000 h.p. 30/60 r.p.m. motors, each driving individual rolls of the reversing mill. The top and bottom rolls are each controlled by two generators connected in two separate Ward-Leonard loops as shown in Fig. 1. The motors are controlled up to base speed (30 r.p.m.) by variation of generator output voltage with constant motor field, and from 30 to 60 r.p.m. by variation of motor field current with constant full armature voltage.

The fields of all four generators are supplied by one generator controlled by an amplidyne. The generator fields are connected in series-parallel, so that the armature outputs of the top and bottom roll motors can be controlled independently for load balancing.

The mill operator is seated at a desk in the mill pulpit and controls the mill rolls by means of a hand-operated

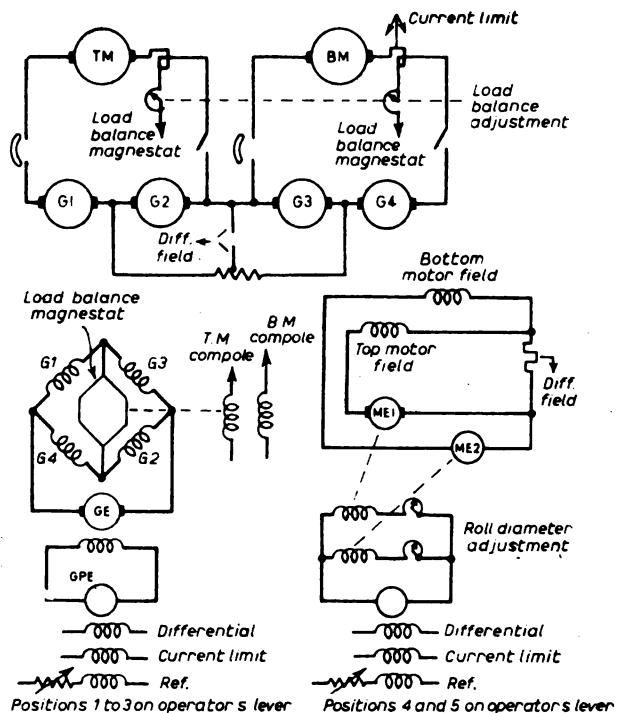


Fig. 1. Schematic diagram of twin-drive control system. M, motor; G, generator; E, exciter, etc.

master controller with five positions forward and reverse. The first three positions of the controller increase the output of the amplidyne controlling the generator exciter, and with the controller in the third position the generator output voltages will be at a maximum value and the motors will run at base speed (30 r.p.m.).

The mill motors have identical field exciters, duplicates of the generator exciter, which are controlled by a common amplidyne. Moving the controller past the base speed position reduces the reference signal to the amplidyne, causing the motor exciters to weaken the motor fields, and the motor speed is thereby increased in the range 30 to 60 r.p.m.

The roll diameter adjustment rheostat enables different values of current in the motor fields to be controlled by a common signal. When the rolls are of different diameters the motors can be set to run at different speeds, so that equal roll peripheral speed may be obtained.

The mill motors are mechanically coupled only when there is metal between the rolls. During rolling the peripheral speed of the rolls will be the same and with rolls of equal diameter the speeds of the motors will also be the same. A load balance magnestat is used to control the load taken by the motors by superimposing a signal in the generator field circuit, adjusting the generator voltages so that the correct load ratio is obtained. By controlling the generator fields rather than the motor fields

* Mr Prowse is with Heavy Plant Division, AEI Ltd. Pt. 1 of this article, by Mr G. H. Sutton, appeared on 13 October, 1960.

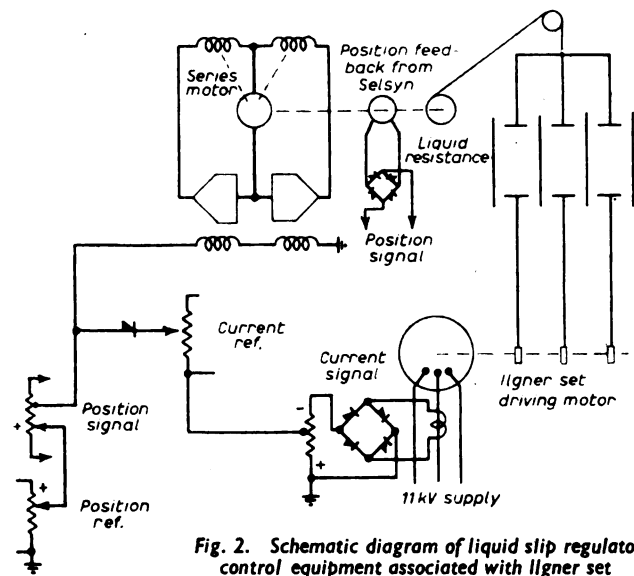


Fig. 2. Schematic diagram of liquid slip regulator control equipment associated with Ilgner set

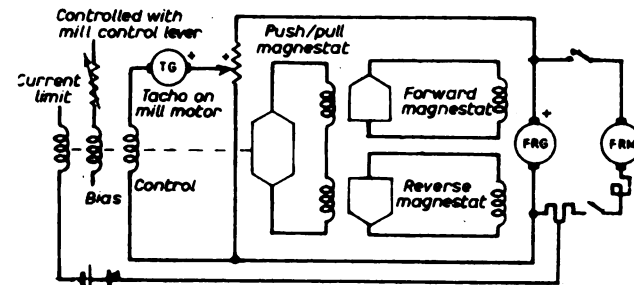


Fig. 3. Schematic diagram for feed roll control scheme

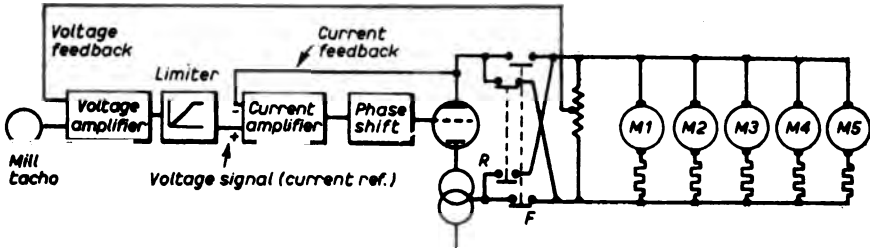
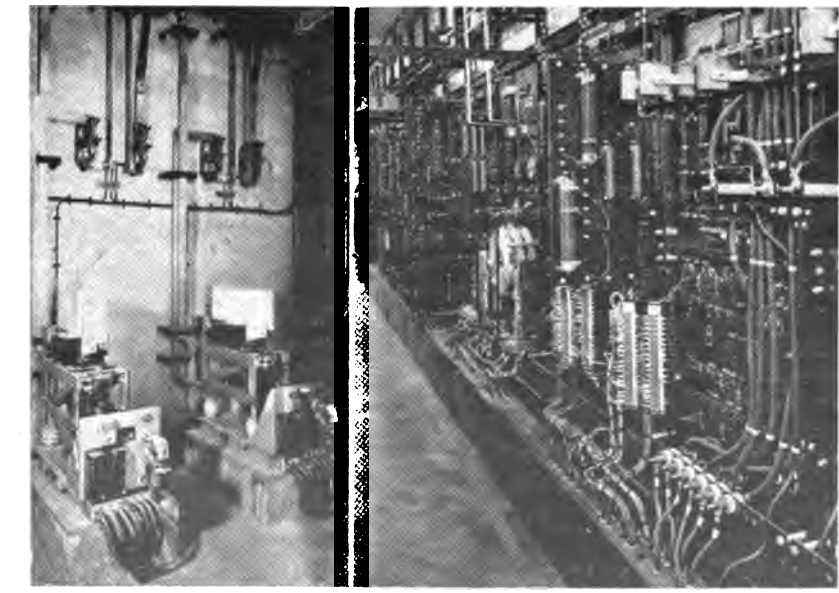


Fig. 4. Schematic diagram for control of main tables; see Fig 8 for further detail



Figs. 5 and 6. Left, Fig. 5, high-speed circuit-breakers and wall-mounted isolators for converters associated with main tables. Right, Fig. 6, back of one of the main control panels

a better response is obtained and optimum motor torque is available. The load balance rheostat permits the armature currents, and therefore the motor torques, to be unbalanced by a controlled amount to improve rolling.

Ilgner Set Control. The generators supplying the mill motors are part of a flywheel motor generator set driven by an 8,000 h.p. induction motor. The flywheel stored energy is used to smooth out the rolling peaks on the supply system. When load on the Ilgner set driving motor rises to more than 1.5 times full load, resistance is inserted in the rotor circuit of the motor causing it to slow down so that energy is released by the flywheel. After the peak rolling is past the set accelerates again and the flywheel stored energy is replaced.

The electrodes of the liquid slip regulator are driven by a small pilot motor which is controlled by a magnetic amplifier position servo, with overriding stator current control. The control scheme is shown in Fig. 2.

To start the Ilgner set the automatic control system puts on a position reference for minimum rotor resistance. The electrodes move quickly to the position required to obtain approximately one and a half times full-load current. At this position the current feedback exceeds the current reference and the "spill-over" signal opposes the position error to arrest the electrodes. As the Ilgner set accelerates, the electrodes are moved in to keep the accelerating current constant.

During rolling, whenever the peak current demanded from the supply exceeds the current reference of one and a half times full-load current, the electrodes are moved out to increase rotor resistance, limiting the supply current, the necessary energy being made up from that stored in the flywheel.

Feed Rolls

The feed rolls, situated each side of the main rolls, feed the material into the mill. They are individually driven by direct-coupled mill-type motors. The feed rolls are controlled to run at the same peripheral speed as the main mill rolls and the control system for one set is shown schematically in Fig. 3.

The main reference is taken from a tacho-generator driven by one of the mill motors, the feed roll generator voltage being regulated to keep feed roll motor speed in phase with mill speed. The feed roll generators are excited by magnetstats. To overcome delay in feed roll response while the reference from the mill tacho-generator builds up, a separate bias signal is applied indicating the position of the main mill controller. This signal is only a small percentage of the main reference, but it enables the feed rolls to move in phase with the mill. The principal signal comes from the mill so that if the mill current limit signal reduces mill speed, i.e., the mill is not running at the speed selected by the controller, the feed rolls will also be slowed down. Close speed matching of the feed rolls is particularly desirable for an aluminium mill in order to minimise marking the material.

Main Tables

In contrast to the main drive, where Ward-Leonard Ilgner control was used to limit the peaks on the supply system, it was decided to feed the main table drive from mercury-arc converters.

The converter drive uses rectifiers connected to the motors through an armature reversing switch. When the motor is on load the converter acts as a rectifier and the motor speed is regulated by grid control. If the motor is to be reversed and has to regenerate, the grid firing is retarded and the armature switch is operated when the motor armature current is zero. Once the switch has operated, the grids are advanced and the converter operates as an inverter, accepting power from the motor and returning it to the supply. In this way a Ward-Leonard type of characteristic is obtained from one set of converter tanks.

The scheme of control is shown in Fig. 4. The reference for the table control is taken from a tachogenerator driven by one of the mill motors. This signal is compared with a signal from converter volts and the error controls the phase shift amplifier. The output of the phase shift amplifier supplies d.c. reactor windings in the static phase shift circuit which supplies the grid firing circuit. Each pair of converters is connected to five 75 h.p. mill type motors through an armature reversing switch.

When the converters are operating as rectifiers, a positive reference increases the amplifier output to advance the grids and increase rectifier output volts. When inverting, a negative reference advances the grids to reduce the inversion voltage and allow the motors to regenerate. The amplifier output must therefore be increased for positive error when rectifying and for negative error when inverting. The polarity of the error signal is changed by contacts on the armature reversing switch.

The switch is controlled by a static switching system based on NOR units. Each of these NOR units can accept three inputs and the output is only present when all three inputs are switched off, i.e., they are analogous to three normally closed contacts in series. The check quantities are:

- (a) Armature current is zero.
- (b) The converter grid firing is delayed to the inversion point.
- (c) The polarity of the control error is correct.

This ensures that the reversing switch does not break current and that current does not flow at the instant of closing in the opposite position until the grid firing has been advanced again. The system is shown schematically in Fig. 8.

The control scheme has been designed to obtain the rapid changes which are essential with this system. The time taken between the change of reference and the change in motor current (and therefore speed) varies by approximately a quarter of a second depending on whether the reversing switch is operated or not.

The response time of the table drive is so small that no special bias winding is required to keep the tables in step with the mill.

Turntables

The turning tables are situated on each side of the mill next to the feed rolls. These tables are about 50% wider

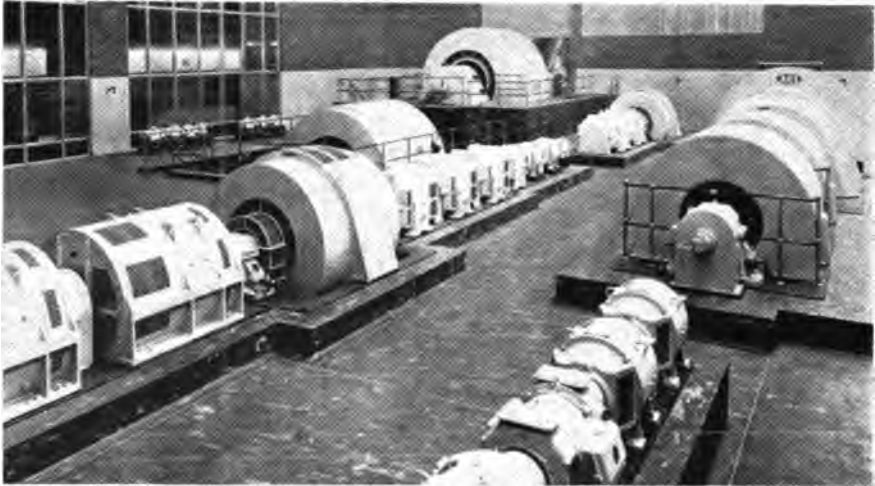


Fig. 7. Hot reversing mill motor room, showing turntable generator set in foreground, Ilgner set on right, main exciter set on left, slab shear set in centre, and the main mill motor

than the other tables and include split rolls with separate drive motors on each side. The split rolls are operated in contra-rotation to turn the piece when necessary during the rolling sequence.

The turntables are driven normally by 75 h.p., mill-type motors, but a booster is connected in series with each motor as shown in Fig. 9. When the tables are used for

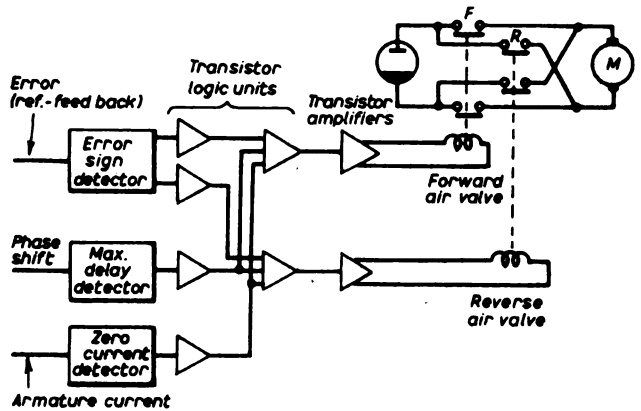


Fig. 8. Armature reversing switch control for converter drive

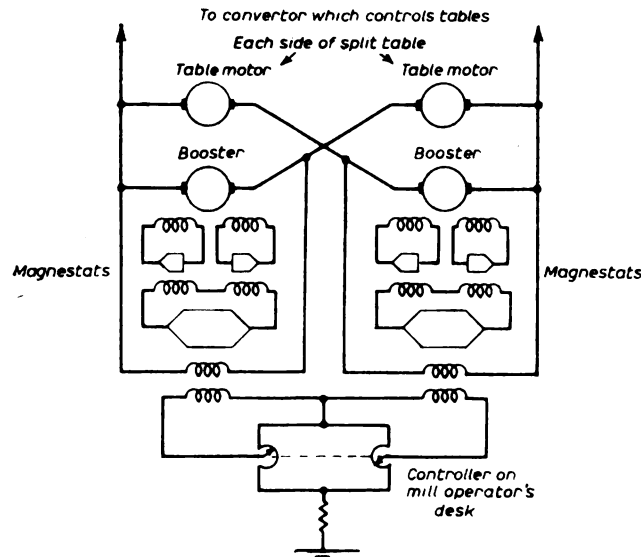


Fig. 9. Schematic diagram for turntable control

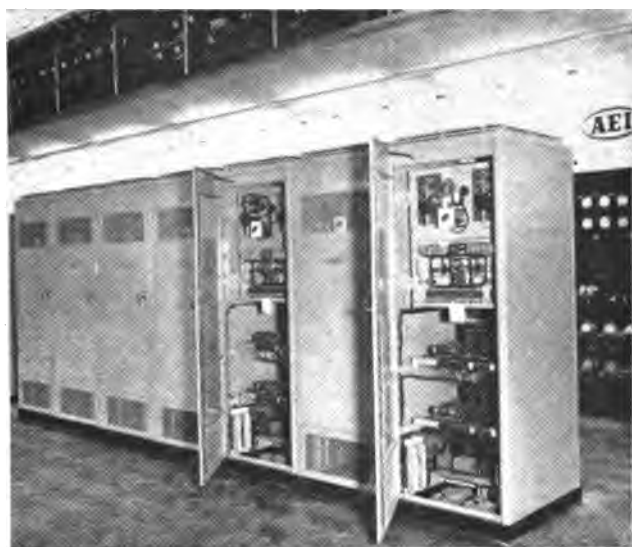


Fig. 10. Magnestats in control room associated with motor room; d.c. panels behind; a.c. panels are on gallery above

turning the piece, the booster voltages are controlled by the operator's control lever through magnetic amplifiers. The boosters are excited with voltages of opposite polarity to cause the table motors to turn in opposite directions.

Screwdowns

The screwdowns control the gap between the rolls and hence the reduction in the metal. For a hot reversing mill the change in roll gap must be rapid and a movement of 2 in. is the normal maximum requirement.

The screwdowns in this mill have a top speed of 50 in./minute and were designed to operate from a controller on the left-hand side of the pulpit desk and in the future by automatic programming. They are also designed to operate with an automatic gauge control system. In order to control the gauge the screws are designed to screw onto the metal during rolling. Under this condition the top screwing speed is limited to 1 in./minute. A switch is available to change screw gear ratio by means of actuators. The screwdowns are designed to withstand the large torques required for screwing onto the metal and some of the parts, for example the main worm spur, are very large. These parts also have to rotate at high speeds when the screws are geared for normal use and in consequence the inertia of the screw is larger than usual.

To obtain fast response of the screws for normal use the screwdown generators are designed to give peaks of up to 3.6 times full-load current on each of the 200/400 h.p. screwdown motors and an exciter has been inter-

posed between the magnetic amplifiers and the generator to give the necessary forcing. The control system is shown in Fig. 11.

Shear

On the outgoing side of the mill is an upcut shear designed to cut up to 4 in. thick plate. It is driven by two 400 h.p. motors. The operation is cyclic. The operator turns the shear cut switch to the "cut" position and the shear accelerates to full speed before the cut commences. During the cut the motors operate at current limit, and the speed is reduced, so that the motors give up some of their stored energy and the torque produced at the shear is greater than the normal maximum torque of the motors at the current-limit setting. After the cut the motors accelerate to top speed again and are finally slowed down and stopped automatically by limit switches. The operator cannot make another cut until the control switch has been released and allowed to return to the neutral position.

The control regulator system is the same as for the screwdowns and duplicate exciters and magnestats are used but the main generators are designed for the special different duties.

Roll Change Rig

The roll change rig is operated by a 75 h.p. mill-type motor with contactor control. The motor operates a carriage which draws out the nest of rolls in the main mill. The carriage moves on a slide and the motor is designed for a large breakaway torque. Special greasing systems are incorporated to reduce the sliding friction to a minimum.

The motor is controlled from a separate control station at the roll change pit.

Solenoid Controls

A number of the auxiliary drives supplied by Davy and United Engineering Co. Ltd. are hydraulic. The most important of these are the side-guides which square up the metal before it enters the mill. They are operated by a control switch on the main pulpit desk. Foot control is also available to trip the solenoids so that the side-guides can be moved out during rolling while they are being used as centring pushers after the piece has been turned. An automatic control system allows the side-guides on the outgoing side of the mill to move out slightly to prevent the metal from striking the ends of the side-guides, when the ingoing side-guides are positioned up to the metal.

The hydraulic operations are all solenoid controlled by contactors on the main d.c. panels.

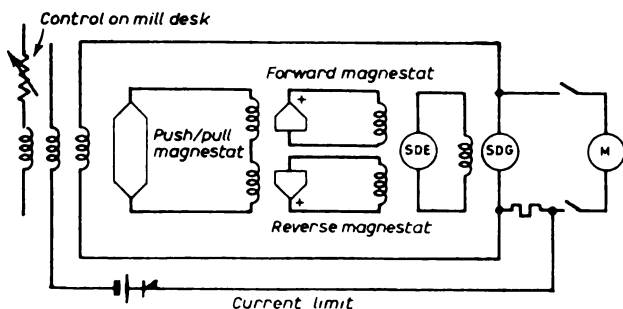


Fig. 11. Schematic diagram of screwdown control

Conclusion

The whole of the hot reversing mill project was coordinated by Alcan Industries' engineering staff and throughout the design stage close co-operation was maintained between the three main parties—Alcan Industries (formerly Northern Aluminium Co. Ltd.), Davy and United Engineering Co. Ltd. and Associated Electrical Industries Ltd. The programme ran to schedule and the mill is now in operation.

[The author wishes to thank Alcan Industries Ltd. for permission to publish this paper.]

Looking ahead on design

RADICALLY NEW APPROACH TO TRANSFORMER BUILDING

DISSATISFACTION with present-day electrical materials and equipment designs is expressed by Mr J. E. L. Robinson, M.Sc., M.I.E.E. (Associated Engineering Ltd.) in his chairman's address to the IEE Supply Section. The dissatisfaction is the proper approach of the engineer, offset by ideas for improvement.

Discussing basic materials, before considering specific types of equipment, Mr Robinson suggests that in some ways development of magnetic material is more advanced than that of dielectrics. Iron has ultimate saturation flux density of about 22.5 kilogauss. A decade ago transformers were still mostly operating at about 13 kG, but with the development of grain-oriented material it can be economic to work at 19 kG. Indeed, but for the necessity for allowing for over-voltage conditions, a density of 20.5 kG would be practicable for large power transformers. This is operation within 10% of the known limit. Mr Robinson thinks there is every reason to expect that better control over metallurgy will yield a more homogeneous material with hysteresis loss, magnetostrictive and noise performance much improved, although perhaps at some economic sacrifice of ultimate working flux density.

Insulation

On insulation, he comments, like many other engineers, on the striking fact that one of the earliest materials—oil-impregnated natural-cellulose paper—is so far unsurpassed for high voltage work in respect of combined mechanical, electrical and life qualities. This despite the fact that it is in so many ways an imperfect material. It involves acceptance of perhaps 150 kV/cm as the maximum a.c. stress, compared with levels of 1,000 kV/cm and more which pure materials can stand: so it is probably only a matter of time before chemists find a way of making a big advance. The great hope for the conductors in electrical machines is superconductivity. If some means can be found of operating within 20°C of absolute zero, the effect on electrical apparatus will be measured in orders of magnitude. In particular, the biggest and most unsatisfactory compromise of present-day techniques would disappear; the designer would enter a field where insulation was required to be simultaneously good electrically and mechanically.

Cables and Switchgear

Turning to discuss particular types of equipment, Mr Robinson begins with cables and here he is particularly provocative. After observing that a.c. makes inefficient use of cable dielectrics, he continues with an assertion that the long-term future of all power transmission must lie with underground cables. Although transmission lines may today be superior to cables on first cost by a factor of about 15%, he feels there is "unmistakably something very nineteenth century about them," and that with further developments of cable dielectrics overhead lines will become outmoded.

Again, Mr Robinson seems unhappy about switchgear. He suggests there is something essentially brutal in the "breaking" of a circuit. Although it works, it does not seem the right way. It seems strange that such similar media as air and oil lead to similar solutions economically. Overall, he does not think it likely that present methods are an ultimate in this field.

Transformer Design

On possible developments in transformers, Mr Robinson (formerly manager of the Ferranti Ltd. transformer dept.) deals with in more detail. Change in this field has been slowly evolutionary. All forms of transformer still involve relatively complicated windings, dependent on a high element of craftsmanship. Moreover, the current tendency is towards greater rather than less intricacy.

Transformers use actively about 85% of the space occupied by magnetic material and some further improvement seems possible. However, conductor space factors are only about 20% in large units, chiefly owing to the demands of insulation and cooling. Although the relation-

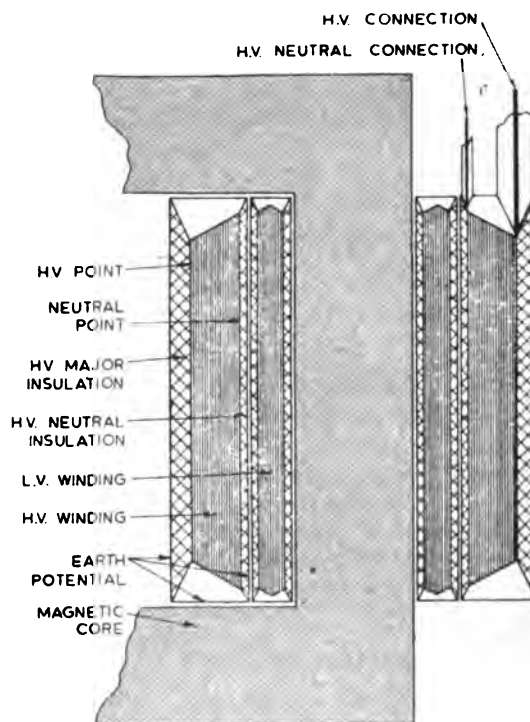


Fig. 1. Axial cross-section through l.v. delta-connected and h.v. star-connected windings of suggested foil-wound transformer. H.V. winding has continuous sheet insulation with capacitance control coatings at suitable intervals. Winding prepared on mandrel, with widths tapered to give required contours at cylindrical ends. On top of winding is formed another capacitance-controlled cylinder, contoured to give equipotentials parallel with end-surfaces of winding cylinder. Cylindrical axial cooling ducts are included in the winding as required. Tapping leads are taken from near neutral end

ships are rather complicated, the weight of the optimum transformer can be taken as inversely proportional to the $\frac{2}{3}$ power of the conductor space factor. If this factor can be raised to 80% then weight and cost will come down to about 40% of present levels—or alternatively, ratings four times higher will be achieved for the same weight.

Mr Robinson suggests that the necessary improvement will be in the form of making each turn of width nearly equal to length of a core leg, and of a few mils radial thickness.

Essentials of this idea are shown in Fig. 1. Advantages include:

1. All solid insulation stressed at a uniform value.
2. Distribution of impulse voltage very closely linear; no local reinforcement of insulation required.
3. Current in windings is free to dispose itself for perfect ampere-turn balance. Axial mechanical forces do not arise. (These are a major limitation with conventional windings.)
4. Since the conductor is thin in the radial dimension, conductor eddy current loss is effectively eliminated.
5. Cooling ducts are in the body of the winding and do not limit working gradient in the major insulation.
6. Tap windings are homogeneous with the main winding in respect of ampere-turn balance and impulse distribution.

To make a transformer of the type envisaged involves many problems of a constructional and manufacturing control nature. Although the conductor will probably remain copper, aluminium with a thin, tough insulating oxide coating has a claim for consideration. Because there will be several acres of insulation between turns on a large transformer, all equally stressed, such insulation must be entirely free from fault. However, so great is the saving in insulation in comparison with conventional methods that even with 5 mils thickness between turns, the new method compares favourably.

It should be possible to make the manufacturing process nearly continuous, and if a successful technique could be evolved the high labour content and craftsmanship of transformer windings would disappear. Cooling systems could be made individually to each leg, the entire winding being enclosed in a cylindrical metal tank with an insulating seam. It would be possible to obtain assembly on site of large transformers from three such complete sealed winding groups. This could open the way to practical use of transformers on several thousand MVA rating.

Earlier in his address, Mr Robinson discusses some essential aspects of engineering, and sees the answer to the problem of too much specialisation in a broader education at school and four years rather than three at university.

Ideas for improving I.E.E. working

CORPORATE members of the Institution of Electrical Engineers received last week a report made to the IEE Council by a special advisory committee set up following stormy general meetings held last summer to consider revisions to by-laws. The committee had the task of reporting to the IEE Council on comments and proposals received from members on activities and organisation of the Institution; and of making recommendations to the Council on ways and means of improving channels of communication between the Council and members.

The Council have decided to send the report to members prior to considering it in detail, to encourage discussion. They warn, however, that detailed consideration by Council may result in some of the recommendations of the special advisory committee not being endorsed.

Better Communication

The report discusses the Institution's working in the broadest manner, and the committee introduce their conclusions by noting that whilst it is clear that some members have become restless and a few seriously dissatisfied with the workings of the IEE, the committee are satisfied that there is nothing basically wrong. Restlessness has stemmed largely from a feeling that Council have become too remote from members, the committee endorsing the Council's own diagnosis that inadequate communications constitute the underlying cause.

Although members have been disturbed for various reasons, the committee are convinced that the majority "would be satisfied by improvement of consultation on major issues, and the avoidance of any semblance of tutelage in communications" of an official nature to local committees or individual members.

Ideas for improving matters include encouragement for local centre chairmen to put forward names for the Council to consider nominating for membership of

Council, and encouragement for groups of members to nominate additional candidates. It is suggested that views of members should be more fully canvassed before decisions are reached on what the report calls "major domestic issues" and, to this end, local centre chairmen should be encouraged to discuss Council questions with their committees. So far as individual members are concerned, the committee recommend that there should be encouragement for them to make their views known both when they approve of what is being done and when they have criticism to offer.

London Members

It is thought it may be valuable to give members living in London and the neighbouring counties some sort of local centre organisation such as covers other parts of the country, and so bring them into "constituency" recommendation on Council. It is recommended that a panel be appointed by the Council to study this problem and make proposals about the appropriate reorganisation. General local centre policy is discussed at length in the report, with a number of detailed suggestions for improvements.

The widely canvassed idea that the papers read before the Institution and at present published in the *Proceedings* should be issued only as "separates" is thought to be virtually unworkable in view of the large number of papers read by the Institution. After considering that and several other possible disadvantages, the committee see no justification for a change in the present procedure.

Other recommendations deal with presentation of financial information to members and details for conducting of special meetings and, in addition, with detailed procedure for election and transfer at various classes of membership.

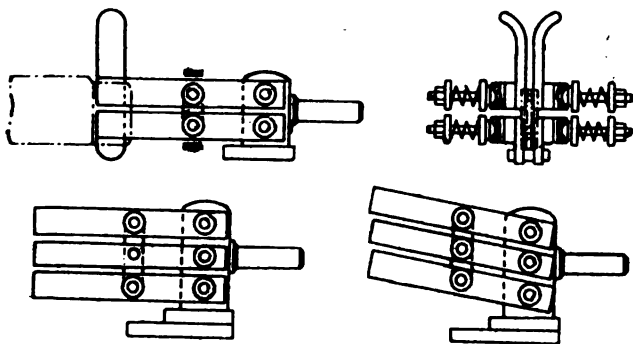
PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Air Breakers for Icy Conditions

Outdoor high-tension air-break switches are particularly sensitive to icy conditions. Whether manual or automatic, a coating of glaze ice on the contacts may be sufficient to prevent them from opening inasmuch as the holding force is almost invariably applied at the point of greatest leverage. Manufacturers are, of course, well aware of the hazard and endeavour to meet it by a variety of subterfuges, some of which are considered to be of sufficient novelty and ingenuity as to justify patenting.

One such specification, No. 851,729, has just been published in the name of VEB Transformatorenwerk Karl Liebknecht of Berlin-Oberschöneweide, Eastern Germany. The moving blades, of conventional pattern, mate with spring-loaded multi-element fixed contacts between which



Air break switch contacts designed to avoid icing difficulties

they enter with a sliding movement from the top. The upper pairs of elements incorporate leading-in extensions which serve the double purpose of facilitating entry of the blades and also to divert the arc from the normal contacting faces on opening. Such an arrangement is liable to freeze solid under conditions of glaze icing but, to counteract the risk, the inventors pivot the elements of the fixed contacts at the base and cross-link them with a connecting bar so that they move upwards and away from the moving blade within limits on opening. It is claimed that this movement will break the coating of ice and free the blades and this may well be so providing only that the intervening space between adjacent elements is not so filled with ice as to prevent movement. No mention of provision to avoid the hazard is in the specification, but it is obvious that some will have to be made.

Electroplating on Sintered Metal

Powder metallurgy is a technique which encompasses many branches of engineering and which is particularly relevant to the ever-widening semiconductor fields. While, therefore, the specification 850,016, credited to Alta Ianos Geptervezo Iroda of Budapest, Hungary, is not directed specifically to electrical applications, it is of pertinent interest.

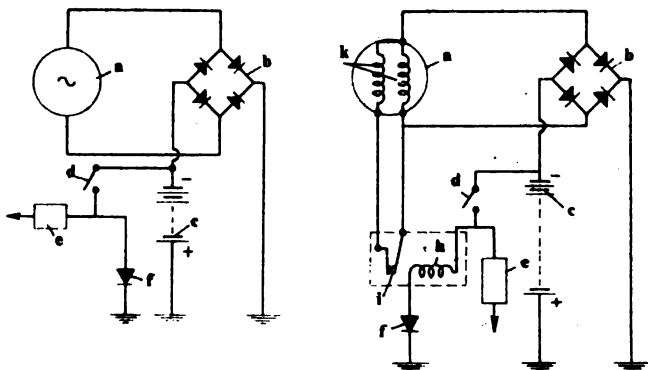
One of the shortcomings of sintered metal components is that they have a porous structure. This is a disadvantage

when the component is required to be plated with nickel and/or chromium since the electrolyte penetrates the body of the component, which may lead to disintegration. In the invention, iron-containing bodies made by powder metallurgy are rendered less porous by forming on the outer surfaces a coating of "blue oxide" such as can be made by applying super-heated steam at temperatures of 550°C to 600°C. The coating so formed is found to be a suitable base for direct electro-plating with copper, nickel or chromium. The oxide on the surface is said to close the pores to such an extent that substantially no corrosion occurs under the deposited metallic layer.

Rectified A.C. for Cars

Although rectified a.c. generation with flywheel magnetos has been used for battery-charging and lighting on motor-cycles for many years, mostly using copper oxide rectifiers, it has not been applied to any extent in the motor-car industry. Now, in specification 851,625, Joseph Lucas of Birmingham describes a method of regulating the voltage on such generating systems, which enables them to be used on cars and commercial vehicles without hazard to the battery and using semiconductor rectifiers.

The output of the alternator, *a*, is rectified through the bridge, *b*, and applied directly across the terminals of the battery, *c*. The rectifiers prevent reverse flow from the battery to the alternator when the engine is shut down



A zener diode regulator is part of this rectified a.c. car generator circuit

without the necessity for a cut-out. To prevent excessive charge at high r.p.m. of the alternator, a zener diode, *f*, is shunted across the rectifier when the ignition switch, *d*, is closed to give supply to the ignition coil, *e*. At a prescribed voltage the diode breaks down, shunting the flow to the battery but, in the manner of such devices, re-establishing its high resistance as soon as the voltage drops again. The load on the alternator may be limited by inserting a resistance in series with the zener diode.

In an alternative arrangement, the breakdown current through the zener diode is used to operate relay, *h*, which cuts out part of the field of the alternator, so lowering the voltage.

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OVERSEAS NEWS



from our correspondents abroad

CANADA

New Cable Plant

Cables from transmission to communication types are to be manufactured in a new \$600,000 factory at Woodside recently opened by Phillips Electrical Co., Brockville, Ontario.

Guarantee against future blackouts for the city of Campbellton was given by Mr J. C. Chatterton at the opening of a new 50,000 h.p. thermal station at Les Boules, Quebec.

Gas Turbine Commissioned

Towards the end of last month, a 26 MW gas turbine was brought into service at the Regina power station, Saskatchewan. The turbine was built by Canadian General Electric and was brought into service earlier than was anticipated to supplement existing generating plant, damaged in an explosion at the station a few weeks ago.

US Defence Orders

So far this year, Canada has received \$70 million worth of defence orders from the United States, said Defence Production Minister O'Hurley recently. The bulk of Canadian orders are for electronic components, and Mr O'Hurley hoped that the figure could soon be raised to \$300 million. Last year Canada's orders amounted to \$96 million.

Generator Arrangement

The imposition of an import duty on steam turbo-generating sets of 700 h.p. and over (noted in our 13 Oct. issue), has obviously pleased some manufacturers in Canada. Such imports have amounted to around \$15 million annually in recent years. It is now revealed that the John Inglis Co. Ltd.—Canadian associates of the English Electric Co.—and Canadian Westinghouse Co. are co-operating in a plan for the manufacture of large sets in Canada. The steam turbines will be produced by John Inglis in its Scarborough works (where a 140,000 sq ft extension is in hand), while Canadian Westinghouse will manufacture the generators at Hamilton. Until recently, all large steam turbo-generator sets installed in Canada have been purchased from other countries, but John Inglis have just completed a 100 MW set for Ontario Hydro's Thunder Bay power station and the Canadian General Electric Co. are manufacturing a substantial portion of the two 300 MW sets

ordered last December for the Lakeview station in conjunction with AEI of Canada Ltd. Mr H. B. Style, president of John Inglis, said his company had installed special equipment, including test apparatus, for the manufacture of steam turbines up to any size required by Canadian utilities. Mr G. L. Wilcox, president, has explained that the size of the Canadian market for such steam turbo-generators—about \$15 million a year for the next five years—was not large enough to justify duplicating the John Inglis facilities for the steam portion of the equipment. But the two companies working together could produce the machines efficiently and economically and could supply an increasing portion of the market.

AUSTRALIA

Remote Supply Scheme

A contributory scheme for electricity extensions has been announced by the Western Australian State Government. Object of the scheme is to enable rural areas to obtain electricity supply more rapidly. The electricity commission will continue to extend their supplies in closely settled areas where they are economical, but consumers outside these areas can now pay for additional extensions. Various schemes for arranging payments are being worked out, including an annual payment, a capital sum to meet initial cost of the line with a further annual charge for maintenance and administration.

Power Too Costly for Farmers

At a recent conference in Devonport, Tasmania, a resolution was agreed calling for a reduction in the cost of providing power supplies to farms. Representatives were told that farmers within a mile of a power supply had found the cost of connection was as much as £500. The conference resolution called on the hydro-electric commission to abolish or considerably reduce such charges.

Bigger Loss

Operations of the Hydro-Electric Commission of Tasmania in the year ended 30 June last resulted in a loss of £180,982, compared with a loss of £55,837 in the previous year, the Auditor-general has just revealed. The loss contrasted with profits of £9,822, £346,403, and £137,951 made in 1958-59, 1957-58,

and 1956-57, respectively. The revenue from the sale of bulk power was £1,756,111 compared with £1,683,625, £1,619,339 and £1,421,232 in the three previous years. Revenue from the sale of retail power was £5,290,640 for the year just ended, compared with £4,864,084, £4,599,040 and £4,271,914 in the three preceding years. Total revenue by the commission for the year amounted to £7,285,437. The increase in the revenue for the year was £562,032, an increase of 8.4%.

S. AFRICA

Plant for Komati

Babcock and Wilcox Ltd. are to supply three 900 klb/hr boilers for the second stage of the Komati power station for the Electricity Supply Commission of South Africa. The order for the associated three 100 MW turbo-generators has been placed with MAN, of Western Germany, but the contract provides for the alternator work to be sub-let to AEG (who are providing the first two 100 MW sets for that station). These latest machines are scheduled to be in service in 1963-64. In the first section of the station, the two 900 klb/hr boilers are being supplied by Mitchell Engineering Ltd. as we reported on 23 Jan., 1958.

Iscor expansion programme

A new expansion programme, announced by the South African Iron and Steel Corporation (Iscor), will cost about £270 million and will extend over 12 years. The programme is expected to raise production of ingot tons to 4.5 million a year by 1972. A £56 million expansion programme is already under way and is expected to be complete in 12 months. A wire rod mill, producing 180,000 tons of wire rod a year, has recently begun operating at Iscor.

FRENCH W. AFRICA

Large Diesel Generator Contract

A contract for 16 MW of diesel generating plant has been placed with the Hawker Siddeley Group by the International iron ore mining project (MIFERMA) in Mauritania, French West Africa. The order is valued at £460,000 and was obtained in the face of fierce international competition.

The generating plant will be installed in two power stations and will comprise

rrlees diesels driving Brush tur-
Power from the diesel generator
ill supply the entire mining and
ndling facilities.

order, obtained by Mirrlees,
on and Day, is said to be the
contract placed by MIFERMA
British organisation and brings the
order intake for the current year
million, of which 65% is from
ort market.

UGANDA

Kabemaido Scheme

missioning of a new substation at
in Teso marks the completion of
ond stage of the Uganda Elec-
Board's Kabemaido district elec-
on scheme. An 11 kV power line
on from the main 33 kV system
ing power to three villages. Work
main system serving the remainder
area covered by the scheme is
d to be finished by the end of
y, 1961.

GREECE

Progress

Impressive figures for power
s in Greece are disclosed in the
for the year 1959, which com-
he first ten years since the estab-
it of the Public Power Corpora-
eneration per head of population
n markedly from 93 kWh in 1951

kWh in 1959, an increase of
In 1956, simultaneous with the
ng of the second power pro-
e, the Greek Government appoin-
as the sole agents for generation
istribution of electric power. They
o be responsible for purchasing
provincial undertakings and
g a uniform low-rate schedule
out Greece.

ng 1959, 77 local utilities were
sed and the number of customers
o 468,000, an increase of 45%.
f electricity at 1,004 million kWh
1959 showed a marked increase
% on the 1958 sales. Revenue also
arply by 31.3% to Drs 620.7 mil-
o meet the increasing demand for
ity, which for the last ten years
eraged 13% annually, markedly
than the 7% annual increase in
Western countries, a considerable
ment programme is under way.
ar, in spite of unusually dry con-
hydro-electric generation amoun-

36.2% at 419 million kWh.
eneration in Greece amounted to
million kWh, of which 735 mil-
Wh was generated by the Athens-
Electric Co. During the year
it 70 MW section of Ptolemais
was completed and the second
of 125 MW was under construc-
t Tavropos three 40 MW units
ned. This year, construction of
the largest hydro-electric projects
ope, the Kremasta-Acheloois de-
ent, has begun and also a further
for 28 MW at Edessaiois. New

150 kV transmission lines are in course
of erection both for serving Greek dis-
tricts and also for linking to the Yugo-
slavian system. In Crete, a 66 kV system,
now completed, forms the backbone for
the island's distribution.

W. GERMANY

Refrigerator Production

This year's production of household
refrigerators in West Germany is ex-
pected to be over 2,200,000, an increase
of 16% on last year. It was recently
stated that every third household now
has a refrigerator.

POLAND

Boiler and Turbine Production

The likelihood of rapid expansion is
reported for the relatively young Polish
turbine and boiler industry. The present
five-year plan covers over 400 MW of
turbines including 50 MW units. In the
subsequent five-year plan to 1965, con-
struction is scheduled for 12-120 MW
units with increases to 320 MW units
by the beginning of 1965.

In the same period, boiler production
is expected to include sizes from the
present capacity of 520 klb/hr to
1,460 klb/hr, designed to use hard and
brown coal as fuel.

NORWAY

Reactor Start-up

Steam was produced for the first time
on 5 Oct. by the heavy-water boiling
reactor at Halden, built by the Nor-
wegian Atomic Energy Institute. Claimed
to be the first reactor of its type in the
world, it is unusual in being constructed
inside a mountain and in being operated

by remote control. The reactor has a
present rating of 5 MW and is being
used for an experimental programme
by a team of European nuclear physicists.
Eventually the output will be raised to
20 MW and it is intended that steam
generated by the reactor will supply a
nearby pulp and paper mill on a regular
industrial basis.

Industrial Plans

The Norwegian Minister of Industry
recently outlined an extensive £250 mil-
lion industrial expansion programme.
Projects included in the plan are a
£4 million coking plant to produce up
to 250,000 tons annually, a kraft paper
mill with an output of 60,000 tons
annually, and a new carbide factory to
produce 40,000 tons annually. Expans-
ion is also being considered in the
aluminium industry, and the iron and
steel industry will benefit by a resump-
tion of mining in the Dunderland Valley
at a cost of £12.5 million and an £8 mil-
lion extension of the Mo i Rana iron
and steel plant. A new ferro-silicon
factory is also in course of preparation.

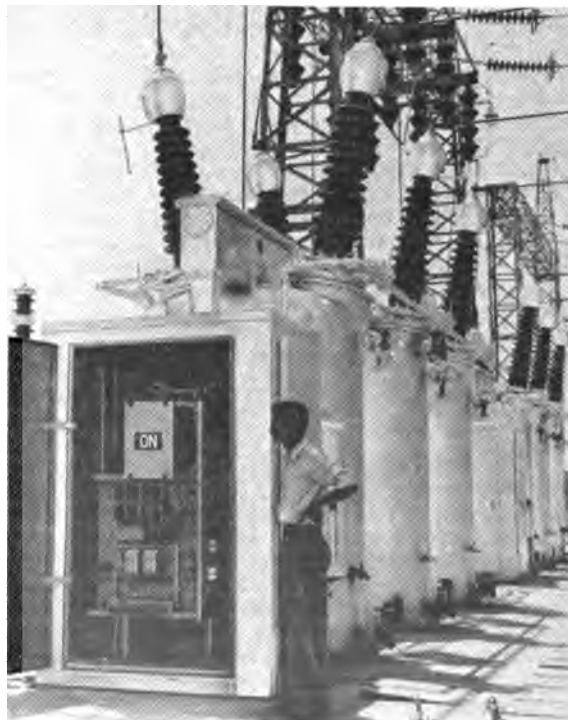
WEST INDIES

Power Station Closure

Passing of an era in West Indian elec-
tricity supply is signalled by a statement
that the Bog-Walk hydro-electric station
will be closed when the present frequency
conversion scheme is completed in 1962.
The station, which was commissioned
towards the end of the last century, has
now become obsolete and in recent years
has only produced 500 kW.

Five other hydro-electric stations
operated by the Jamaica Public Service
Co. require only minor conversion and
will continue to operate.

*Part of a contract
worth over Rs3 million,
this outdoor switching
station at Roorkee, 140
miles N.E. of Delhi, has
equipment supplied by
the General Electric Co.
Ltd., through its sub-
sidiary, the GE of India
Ltd. Our illustration
shows one of the five
132 kV, 1,500 MVA oil
circuit-breakers. The con-
tract included ten 66 kV,
500 MVA oil c.b.'s, 53
rotary isolators, 12 three-
phase sets of surge di-
verters, 132 kV and 66
kV voltage transformers,
control and relay boards,
11 kV and 400 V indoor
switchboards, compres-
sors and batteries. All
c.b.'s are arranged for
local or remote opera-
tion. Because of the wide
variation in temperature
and humidity in the area,
heaters are fitted above
the oil level in the cir-
cuit-breaker tanks and in
the operating kiosks*



Personalities *in the industry*



Mr H.P. Barker



Mr H. G. Campbell



Mr J. D. Dale-Lace



Mr N. Robinson



Mr P. McKenna

Chairman and managing director of Parkinson Cowan Ltd., **Mr H. P. Barker**, M.INST.GAS E., M.I.E.E., M.I.MECH.E., M.INST.T., F.B.I.M., was last week elected chairman of the British Institute of Management of which he is a founder member. Mr Barker served an engineering apprenticeship with the Otis Elevator Co. and after a period in business on his own account making electric heaters, and experience with the French meter and instrument firm, Compagnie des Compteurs, joined the board of Measurement Ltd., a subsidiary of Parkinson and Cowan, in 1938. During the war he was for four years with the MAP, latterly as deputy director of instrument production. He subsequently became engineering director of Parkinson and Cowan, then managing director and, in 1956, chairman.

Dr S. English, D.S.C., M.I.E.E., F.I.E.S., F.INST.P., has now relinquished his position as chairman of Holophane Ltd., having retired from all executive duties in December last. The new chairman of the company is **Mr H. G. Campbell**, T.D., M.A., A.M.I.E.E., A.M.I.MECH.E., F.I.E.S., who is also managing director of Benjamin Electric Ltd. Dr English, who is remaining on the board of Holophane, was earlier this month made an hon. member of the Illuminating Engineering Society, of which he was president in 1937-38. He joined Holophane 33 years ago as head of their research department, became technical director in 1936, deputy managing director in 1946, joint managing director in 1949 and, from 1955 to 1957, was vice-chairman, afterwards becoming chairman.

Boiler plant design engineer at the headquarters of the CEBG since 1952, **Mr F. Dransfield**, B.SC.(ENG.), M.I.MECH.E., A.M.I.E.E., M.INST.F., has been promoted to power plant design engineer. (*ESH, page 47.) Mr Dransfield joined the staff of the Yorkshire Electric Power Co. in 1916 and became boiler house superintendent with Leicester Corporation Electricity Department in 1924. From 1932 to 1938 Mr Dransfield was boiler plant

manager with Castner Kellner Alkali Co. and from 1939 to 1950 was employed by Babcock and Wilcox Ltd., first as a senior service engineer and then as a boiler design engineer. In March, 1950, he joined the staff of the then British Electricity Authority as a senior assistant engineer in the Generation Design Branch of headquarters, and in 1952 became boiler plant design engineer.

Formerly guided weapons service manager to de Havilland Propellers at Hatfield, **Mr J. D. Dale-Lace**, A.M.I.E.E., D.F.H., has been appointed sales manager of Radio Components and Special Products Department, AEI Radio and Electronic Components Division. He was trained as an electrical engineer at Faraday Hse, where he obtained the Faraday Hse Diploma in electrical engineering. In 1940 he joined the Royal Navy as an Electrical Officer and was demobilised with the rank of lieutenant in 1946. He then joined Pye Ltd., of Cambridge, where he worked on the development of television transmission equipment. Mr Dale-Lace went to South Africa in 1947, where he was for four years technical representative for the Sperry Gyroscope Co.'s South African agents. He rejoined Pye in 1951 as a telecommunications sales engineer and eventually became senior export sales engineer for telecommunications and specialised equipment before joining de Havilland Propellers in 1956.

The end of this month will bring the retirement of **Mr L. Douglass**, A.M.INST.C.E., M.I.E.E., from the position of engineer and secretary of the Isle of Man Electricity Board. From 1 Nov. he will be succeeded in that post by **Mr H. Williamson**, A.M.I.E.E., who is now chief assistant. (*ESH, page 179.) Mr Douglass took over as engineer and secretary late in 1942, relinquishing the position of district manager to the Cornwall Electric Power Co. which he had held since 1935. Earlier, Mr Douglass was power station superintendent to the Ceylon Government from 1928 to 1930, serving at Colombo. From then until

1935 he was engineer and manager to the Dacca Electric Supply Co., Bengal. He reorganised the Patna Electric Supply Co. system following an earthquake in 1934.

Mr Neville Robinson has been appointed deputy controller of publicity to the General Electric Co. Ltd. and has resigned from Union International Ltd. Prior to becoming advertising manager to the latter concern in 1955, Mr Robinson was with Mather and Crowther and for a number of years their executive for the EDA and British Electricity campaigns. Before the war he worked on the sales side of Radiation Ltd.

General manager of the Perak River Hydro-Electric Power Co. Ltd., **Mr J. F. Hannah**, D.S.O., P.J.K., has returned to this country from Malaya prior to retirement. His successor in that position is **Mr J. W. Smith**, who joined the company in July, 1938 and, since the war, has been successively, distribution superintendent and chief engineer. Newly appointed generation superintendent to the company is **Mr F. B. Monkhouse**, A.M.I.E.E.

Mr P. McKenna, who, as we briefly noted earlier this month, has been appointed marketing director of AEI-Gala Ltd. (the export organisation of AEI-Hotpoint), was previously deputy general manager of their International Division. He joined AEI-Hotpoint in July, 1957, was appointed marketing manager, home laundry, the following year, and transferred to AEI-Gala Ltd. in August, 1959.

To mark his completion of 50 years' service with Nalder Bros. and Thompson Ltd., **Mr E. W. Semmens**, A.M.I.E.E., managing director, was last week presented with a radiogram by Mr A. O'Neill, M.I.E.E., chairman, on behalf of the directors. Mr Semmens progressed from a test room engineer to become production manager, and was elected to

* Denotes revision to the "Electricity Supply Handbook, 1960."

the board of directors in 1950. He became managing director in 1957. Mr Sermmens is chairman of the Instrument Section of BEAMA and a member of the Council of the Scientific Instrument Manufacturers' Association.

Mr R. M. Gledson, B.Sc., has been appointed a director of J. Gledson and Co. Ltd., electrical wholesalers, of Newcastle upon Tyne. After leaving Loretto School, Edinburgh, Mr Gledson served his time with C. A. Parsons and Co. Ltd. and graduated in electrical engineering at Durham University. Mr Gledson is the son of Mr W. R. Gledson and grandson of the late Mr J. Gledson, who founded the company in 1912.

Mr Claud Laurence has resigned from the board of Laurence, Scott and Electromotors Ltd. after 37 years' service. His son, **Mr J. A. Laurence**, has been appointed to the vacancy thus created. Mr J. A. Laurence, like his father, is a member of the Stock Exchange, London.

Founder and managing director of Dynamo and Motor Repairs, **Mr T. A. Atkinson** is retiring from full-time employment with the company at the end of this month. He will remain as consultant for a time. Mr Atkinson, who is 68 years of age, founded the company in 1920. Earlier he was works engineer with Lancashire Dynamo and Crypto, which is now also in the Metal Industries group. Mr C. E. Vincent, who joined the company in 1958, has been appointed director and general manager of Dynamo and Motor Repairs in succession to Mr Atkinson.

Wolf Electric Tools Ltd. announce that **Mr D. F. Kershaw** has been appointed general manager of their Canadian branch.

Mr E. Humphrey Browne, deputy chairman of the National Coal Board, has been appointed a director of the National Industrial Fuel Efficiency Service.

Messrs **A. K. Graighead, T. I. Hobart, T. L. Reed** and **G. E. Richards** have been appointed to the board of Allied Ironfounders Ltd.

We briefly referred last week to the promotion of **Mr L. E. Gates** as sales manager of Berry's Water Heater Division; we are now able to reproduce his portrait, below. Mr Gates has been Berry's representative in London and the South East for the past seven years.



Mr L. E. Gates



Mr F. J. Edmonds



Mr N. L. Lupton

Mr A. B. Cohen (second from left), chairman of the Southern Rhodesia Electricity Supply Commission for nearly 22 years, retired on 15 Oct. He is seen here with his wife at a reception given in Salisbury by the Federal Minister of Power, Sir Malcolm Barrow, right. On the left is Mr J. W. Phillips, a member of the Commission



In recognition of his 50 years' service with Parmiter, Hope and Sugden Ltd., a dinner was given in honour of **Mr G. Ashleigh Long**, a director and London manager of the company, recently, at which he was presented with a gold wrist watch by **Mr E. W. Sugden**, chairman and joint managing director. Mr Long's career with the company was interrupted by war and, returning to the firm in February, 1919, he became personal assistant to Mr Vernon Hope. Two years later he was appointed northern area representative and in 1930 opened the company's London office. Mr Long, who became a director in 1936, will continue in his present capacity with the company.



At the presentation, left to right: Miss D. B. Long, Mr G. A. Long, Mr E. W. Sugden (chairman and joint managing director), Mrs E. W. Sugden and Mr J. V. G. Hope (joint managing director, Parmiter, Hope and Sugden)

Mr F. J. Edmonds has been appointed general sales controller of Sunbeam Electric Ltd. in charge of the whole of the company's sales and advertising activities. In this capacity he is directly responsible to the managing director. He will operate from the London offices. Mr Edmonds joined the staff of Sunbeam a year ago as general merchandising manager following a period in sales consultancy. He has been engaged in the

electric domestic appliance field for many years and was previously general sales manager of Remington Shavers for a number of years.

Mr D. Saward has resigned from the position of managing director of Texas Instruments Ltd. in order to devote more time to his other activities, but he remains a director. The new managing director of the company is **Mr A. N. Provost**. A former naval officer and an engineering graduate of Tufts and New York Universities, Mr Provost served with Sylvania Electric Products, becoming corporate manager of management engineering. Later he was appointed chief engineer of Mergenthaler Linotype,

before joining the Semiconductor-Components Division of Texas Instruments Inc. in Dallas, Texas, USA, as chief industrial engineer. Subsequently, he combined this duty with that of chief mechanisation engineer, before being appointed manager of the Special Computer Devices Department in January, 1959.

Formerly commercial manager of Microcell Ltd., **Mr N. L. Lupton, M.A., A.F.R.A.E.S., A.S.M.A.**, has joined the Plessey Co. as contracts manager of the electronics and equipment group. After war service with the RAF, Mr Lupton joined the Sperry Gyroscope Co. Ltd. in 1941 as a service engineer in their aeronautical department. In 1941 he was seconded by Sperry to the US 8th AAF as an armament specialist and later became founder and chief instructor of the US Power Turret School at Kirkham, Yorkshire. After his return to Sperry in 1944, Mr Lupton held various appointments in the company's Sales Division and then joined Microcell Ltd. in 1958.

Four new appointments are announced by Nash and Thompson Ltd. **Mr R. G. Smith** is now contracts manager, responsible for all sub-contract activities; **Mr A. L. Lee** becomes sales engineer for the Midlands and Northern England, responsible for the sales of metallurgical, process control, survey and electronic equipment; **Mr D. H. Yates**, previously with A. H. Hunt (Capacitors) Ltd. has joined the company as sales office manager and the position of chief inspector has now been filled by **Mr A. Ward**, previously with Wayne Kerr Laboratories Ltd.

Works manager of the Leatherhead factory of Thermega Ltd., **Mr V. E. Swindells**, M.B.E., has retired on grounds of ill health after 32 years' service with the company. He was responsible for

the beginning of 1959 and remained in that post until he took up his present appointment. Mr Watts entered the industry in 1941 and did his early training with the Ipswich Corporation undertaking. He continued with the Eastern Board until 1958 when he was appointed district engineer at Grimsby. He recently transferred to the Commercial Department succeeding **Mr E. H. Jubb** who was appointed district manager at Gainsborough earlier this year.

Mr T. Hannaby, M.S.M.A., has been appointed general sales manager of Mine Safety Appliances Co. Ltd. Earlier he was for four years sales manager of Multitone Electric Co. Ltd., after being on the overseas sales staff of the Automatic Telephone and Electric Co. for several years.

At the farewell luncheon to Mr V. E. Swindells, works manager of Thermega Ltd., seen in the centre. On the right is Major J. R. Donnelly, managing director, and, on the left, Mr R. E. Mackenzie, the company secretary



introducing a number of patents which made a valuable contribution to the safety and efficiency of electrically heated textile appliances and his advice was appreciated by members of the British Standards Committee responsible for drafting BS 2612 of 1955—the original standard for domestic electric blankets. He was awarded the M.B.E. in 1958 for his work in encouraging severely disabled ex-service men and women to become self-supporting citizens. Our photograph above was taken at a farewell luncheon to Mr Swindells, when he was presented with a bedside tea maker.

Mr A. E. Richards has been appointed managing director of Universal Matthey Products, the joint subsidiary company of Universal Oil Products Co. and Johnson, Matthey and Co.

Mr J. D. Blount, A.M.I.E.E., has been appointed district engineer at Grimsby, No. 7 sub-area of the Yorkshire Electricity Board, to succeed **Mr J. W. Watts**, A.M.I.E.E., GRAD.I.MECH.E., who, as we earlier reported, has been promoted to senior assistant engineer (commercial) at the sub-area headquarters. (*ESH, page 147). Mr Blount received his early training as a student engineer with Laurence Scott and Electromotors Ltd. and entered the electricity supply industry in 1949. He joined the Yorkshire Board in 1953, but took up an appointment as district engineer in Famagusta with the Cyprus Electricity Authority in 1955. He returned to the No. 7 (Grimsby) sub-area as a second assistant district engineer at

Belfast Corporation Electricity Committee have appointed **Mr A. H. Wilmoughby** as generation engineer in charge of the Corporation's power stations. He succeeds the late **Mr H. Weston**, to whom he was assistant. (*ESH, page 177.)

The South Western Electricity Board have appointed **Mr J. H. Sponton** as manager of their Honiton branch, in succession to **Mr W. H. Badham**.

OBITUARY

Mr W. H. Hay, chief purchasing officer of Gent and Co. Ltd., has died, aged 65. Commencing with the company in 1921, Mr Hay joined the cost office staff where, after a period of two years, he was transferred to the Purchasing Department. In 1925 he was made head of the Purchasing and Stores Department and in 1952 was given the title of chief purchasing officer.

Sir Charles W. C. Marr, K.C.V.O., D.S.O., who supervised the erection of the first wireless station in Australia for the Commonwealth Government, died on 20 Oct., aged 80.

Mr J. W. Arthur, M.I.E.E., who was borough electrical engineer and manager at Reading from 1934 until retiring in 1947, died on 17 Oct., aged 78. He joined that undertaking, then the Reading Electric Supply Co., in 1904, ultimately being chief technical assistant to the managing director. When the Corporation acquired the undertaking he was appointed engineer and manager.

NEW LITERATURE

Electrical Contractors' Year Book, 1960-61

CONFORMING in pattern to its predecessors, this latest edition brings up to date all the information relating to the contracting industry. It is largely devoted, of course, to the membership of the ECA, which, in addition to being presented alphabetically, is broken down into area sections. Other parts of the annual cover the law for electrical contractors, working conditions and standard wage rates, and an index providing quick reference to the various sections. As with earlier volumes, this edition is sure to find a ready use in many offices. Published by the Electrical Contractors' Association. 764 pages, 9½ in. by 4½ in. Price 25s.

Electricity in Buildings

edited by T. Dannatt

THERE is often a complaint that architects are insufficiently briefed on electrical services in buildings; that they make inadequate provision for socket-outlets and that their knowledge of basic lighting principles is woefully out of date. The complaint is not invariably justified though there are many instances where a little more thought could have been put into the original planning. In this excellently presented supplement to the Architects' Year Book, Volume 9, a number of contributors, each a specialist in his own branch of electrical engineering, have joined to present a useful survey of the aspects of electrical services in building with which the architect should be familiar. Floor-warming and service lifts, telephones and wiring systems and, of course, a special article on planned lighting all serve to bring the established architect up to date and to make the rising generation more aware of their responsibilities in this field. Published by Elek Books Ltd. Price 10s 6d. 102 pages, 10 in. by 7½ in., with diagrams and illustrations. Paper covers.

BOOKS RECEIVED

The Million-Dollar Bend, by C. Eisler. Autobiography of Charles Eisler, U.S. manufacturer. Published by the William-Frederick Press, New York, 306 pages, 8½ in. by 5½ in. Price \$4.75.

Examples of Structural Steel Design to Conform with the Requirements of BS 499: 1959, by L. E. Kent and E. G. Lovejoy. Revision of an earlier edition showing complete analysis and design for two single storey sheds with pitched truss roofs 50 ft span. Published by British Constructional Steelwork Association, 66 pages, 11 in. by 8½ in. Price 3s 6d.

Enzyklopädie der elektrischen Isolierstoffe. Classification, comparison tables and data sheets, prepared by the Swiss Electrotechnical Committee in association with International Electrotechnical Commission. Published by Schweizerischer Elektrotechnischer Verein, Zürich, 83 pages, 11½ in. by 8 in. Price Swiss francs 22.

Change at Crewe. Widely illustrated booklet telling the story of rail modernisation on the Manchester-Crewe line. Published by British Railways, London Midland Region, 44 pages, 12½ in. by 9½ in. Price 5s.

ation of Exports
y's Sterling
× = over 25% increase
+ = 10% to 25% increase
S = 10% + to 10% -
- = 10% to 25% decrease
÷ = over 25% decrease
on previous year's figures.

EXPORTS
IMPORTS

September

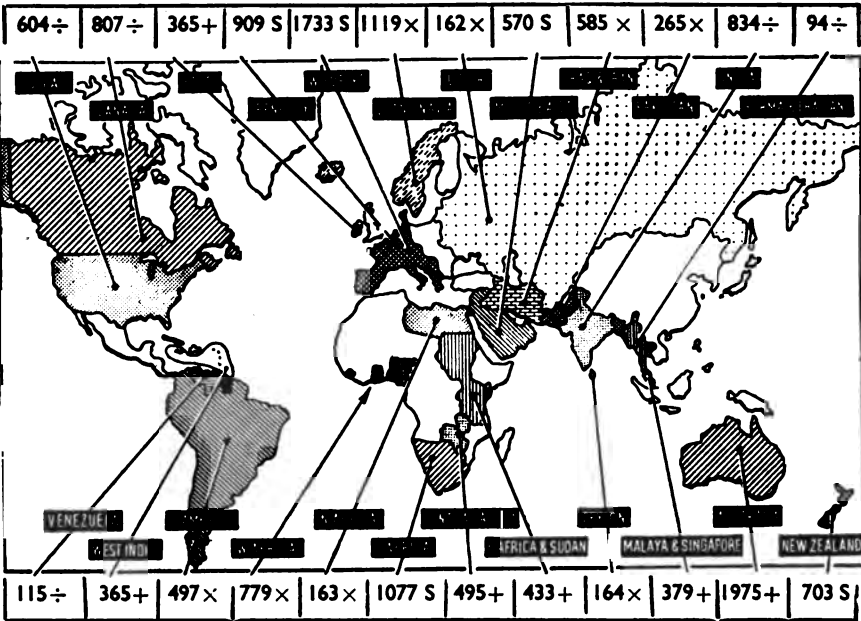
HOUGH slightly higher than in the corresponding month of last year, exports of electrical goods listed in the table were the lowest for September, being over £1 million down on the September of last year. It is notable that the strike of tally clerks at the Port of London may have been a contributory factor to blame, and later weeks will show whether there has been subsequent improvement.

The total for September, £19,042,110, was 11% down on that for August, over £1½ million down on that for July, and in this decline the heavy decline was the prime sufferer, substantial exports of transformers, 500 kVA.

In the domestic appliance section are seen a tenaciousness to their markets which has topped the £2½ million mark, showing an improvement in exports of washing machines.

In the case of cables, there is the familiar story of a further decline, even seriously affecting exports of the thermoplastic insulated types.

Italy was our best market for September, taking goods to a total value of £755,544, and South Africa was only other customer to top the million mark, with £1,077,827. Exports to Canada, in particular, dropped 25%, but trade with Western European countries continues at a steady pace. The sharp drop in exports to the United States is indicative of the latter's payment problem.



Description	Exports Value (£)		Imports Value (£)	
	Sept., 1959	Sept., 1960	Sept., 1959	Sept., 1960
Generators				
Diesel up to 200 kW	363,766	299,310		
Diesel over 200 kW	203,645	168,458		
Steam turbine driven	4,949	36,977		
Water and gas turbines	163,203	368,967	102,513	106,685
With i.c. and other prime movers	25,778	9,064		
Generators up to 200 kW	95,350	69,430		
Generators over 200 kW	19,947	9,277		
Generator parts	575,035	207,863		
Motors, f.h.p.	186,455	278,674		
Motors 1-250 h.p.	370,998	375,088	164,726	209,717
Other motors	621,010	287,195		
Motor starters and controllers	245,738	246,146		
Converters and rectifiers	61,039	45,348		
Transformers	661,306	867,050	85,313	199,654
Switchgear, to 22½ A, mv	293,999	383,010		
Switchgear, other	750,073	1,012,831	95,814	130,229
Total, Electrical Plant	4,642,291	4,664,688	448,356	646,285
Batteries, primary and parts	494,289	727,015		
Lamps filament, over 28 V	87,339	93,435		
Lamps filament, under 28 V	22,495	26,457		
Fluorescent and other lamps	98,172	97,046		
Radio and electronic gear	3,119,522	3,424,213	1,504,203	1,623,440
Telephone and telegraphic equipment	1,706,378	1,094,518		
Cookers	32,381	45,189		
Toasters	19,359	15,810		
Other cooking appliances and parts	118,084	94,764		
Space heaters	21,944	29,259	145,361	196,981
Water heaters	20,596	26,467		
Other heaters and parts	91,831	107,605		
Electric irons	71,091	67,884		
Vacuum cleaners	157,850	212,262		
Floor polishers	42,682	39,326		
Food mixers	58,317	58,824		
Washing machines, domestic	377,276	503,590		
Dryers	63,359	122,702		
Washing machine and dryer parts	372,115	722,021	221,042	253,653
Domestic refrigerators and parts	212,491	308,516		
Other appliances and parts	1,661,372	2,374,595		
Total, Domestic Appliances				
Portable power tools	174,583	228,270		
Arc welding plant	78,300	71,058		
Resistance welding plant	49,490	40,143	61,176	53,874
Electric furnaces	56,848	118,613		
Signalling apparatus	135,557	126,509		
Commercial instruments	143,877	172,354	168,213	191,849
House service meters	174,937	128,574		
Wiring accessories	166,721	181,190		
Fans	83,958	90,494		
Lighting fittings and lanterns	256,510	319,954		
Other lighting equipment	90,227	88,035		
Telephone and telegraph cable	772,035	198,484		
Paper insulated cables	356,523	442,452		
Rubber insulated cables	245,890	296,330		
Thermoplastic insulated cables	422,889	223,557		
Winding and similar wires	106,553	134,847		
Other cables and wires	135,082	143,708		
Total, all cables and wires	2,038,972	1,439,378		
Accumulators and parts	287,279	332,125		
Insulating materials	190,830	170,205		
Electrical ware	71,643	63,716		
Industrial electronic control gear	180,604	220,068		
Permanent magnets	41,812	68,627		
All other articles	2,290,671	2,680,830	1,366,106	1,868,917
Total	18,263,651	19,042,110	3,914,467	4,834,999

NUCLEAR CLEAN WORKSHOP

ONE of the problems affecting manufacturers of nuclear equipment is that of ensuring the utmost cleanliness of all components which are likely to come into contact with the gas circuit of gas-cooled reactors. This is entirely separate from the problems associated with the handling of the nuclear materials, as fuel elements and fuel-element cans which have to be processed under conditions of radiation hazard. The non-radioactive components may, however, introduce into the gas stream metallic or other dusts which, distributed by the circulating gases in the reactor, could have adverse effects of a metallurgical or chemical nature on the fuels or capping materials, affecting the life and performance of the reactor.

Materials such as boron, cadmium and cobalt and, in a lesser degree, chromium, manganese, platinum, rhodium, tungsten and vanadium, all of which are alloying constituents of the high duty steels, have high neutron-absorption characteristics. They could be present as fine swarf particles trapped in interstices and left over from machining processes or merely as metallic dusts deposited from non-associated operations in the vicinity. Even the non-absorbing dusts could constitute a hazard if they settle on burst-cartridge detector equipment and cause spurious operation.

All components which will eventually come into direct or indirect contact with the gas stream must, therefore, be freed from all dust and metallic particles and enclosed within a dustproof wrapping or container at the factory. This necessitates a special workshop in which the air is filtered and cleaned and the use of protective clothing for the personnel at the very least.



General view of the GEC nuclear clean workshop at Erith

Converting a Workshop

In a new factory the provision of such a room is comparatively simple but, in many cases, it is more convenient to convert existing space into such an enclosure. The nuclear clean workshop which has recently been completed at the Erith Engineering Works of the GEC is such a conversion.

The dimensions of the shop are 85 ft 6 in. by 42 ft 6 in. by 30 ft high, and this includes the 25 ft by 25 ft by 11 ft 3 in. high reception bay. Melamine surfaced hardboard mounted on a grid framework forms a false roof in which are mounted the flush fluorescent lighting fittings. The walls of the building are also faced with the same material which provides a glossy, dust-free surface overall. The original floor was heavily coated with a lead base paint and this had to be removed before sealing with a special sealant while a metal-free paint, to a close specification, was used on brick and steelwork.

The reception bay is capable of being isolated from the assembly area by partitioning doors and also by a sliding roof which gives an opening 23 ft by 16 ft to permit the transport of larger portions of equipment into the area by means of the 10-ton overhead crane. The

outer entry-door which gives access to the reception bay is 16 ft wide by 10 ft 6 in. high. Interlocks prevent more than one door or the roof from being open at the same time.

The air filter system pressurises the area with 35,000 c.f.m. from an air and pressurising system, which incorporates a heating system capable of raising the air temperature by 40° F in cold weather. A vacuum cleaning plant, driven by a 20 h.p. motor, serves seven take-off points to which the cleaning personnel connect suction hoses. Compressed air, at 10 sq in. is also provided to eight outlets, four of which are used for the sprayers which cover the cleaned components with Trilac. The cleaning process comprises the removal of scale, rust, and grease, coating with Trilac, encasing the component in a polythene bag together with a bag of pellet desiccant. The bag is subsequently sealed.

All operators in the area wear protective clothing and skull-caps which are stored in an adjacent room which serves as the personnel entrance. In addition to the measures detailed above, the walls and surfaces of the building are vacuum cleaned at routine intervals.

Common Engineering Exams

Inst. C.E., I. Mech. E., I.E.E.

CO-OPERATION between the three senior engineering institutions was discussed by Prof. O. A. Saunders, president of the Institution of Mechanical Engineers, at the Institution's annual dinner last week. He said that the council of the I.Mech.E. were convinced that this collaboration would be profitably developed while retaining the independence of the three institutions. In particular, there was a great need for a common examination structure which would enable a young man to qualify academically for membership of any or all of the three institutions.

Prof. Saunders said he felt strongly that it was unreasonable and wrong to expect a man in his teens to make up his mind which branch of engineering he was going to pursue for the succeeding 40 years of his life. He was happy to say that the presidents of the other two institutions had had most cordial discussions with him on this and other matters.

Toast of the I.Mech.E. was proposed at the dinner by Sir Patrick Linstead, rector of Imperial College, U.L. He

commented on the current attempt being made to increase the university population in this country to 175,000, double the total of four years ago. He was confident that this could be achieved and he argued against those who doubt whether the supply of young talent would hold out; those who said the bottom of the barrel was already being scraped. He thought that the barrel had a long way to go to the bottom; that there was still a lot of good stuff in it.

Expansion Practicable

Sir Patrick quoted a survey of national service recruits to the Army, in which it had been found that of the group classified as "most able," four out of ten had not taken examinations at GCE advanced level. His own experience convinced him that the size of a college could be greatly increased without a fall in standards.

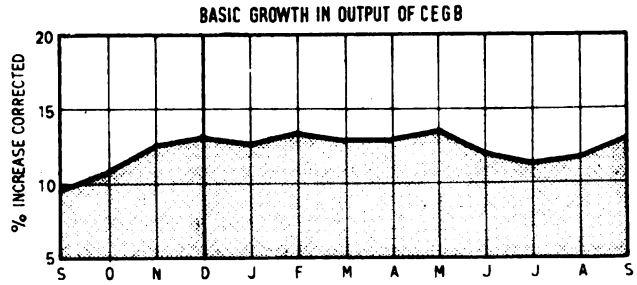
There were three broad reasons why it was good for a young man to become an engineer. It was a wonderful means of education, it established him as a national asset and it gave him the opportunity of improving the lot of peoples of under-developed countries.

POWER SUPPLY

Statistics for September

IN contrast with the month of August, during September the most marked increases in units sent out to consumers by the electricity boards over last year occurred in the mainly non-industrial areas supplied by boards in southern and eastern England. The Southern Board increased its unit sales by nearly 30% over September last year and similar increases were reported by the South Eastern, South Western and Eastern Boards. In total, Area Board sales rose by 19% during the month, compared with last year and even when corrected for average temperature and number of working days, the increase of 13% is higher than for some months past. In the mainly industrial areas, where industrial consumers took more than 50% of the total sales in 1959, consumption rose during the month by 16.6% while in the non-industrial areas, the rise was 23.4%.

Commissioning of plant also showed a considerable increase on the past few months. The output capacity of the CEGB rose by 172 MW to 25,937 MW, an increase of 5.9% on September last year. Largest of the three turbo-alternators commissioned during the month was No. 2 set at Northfleet (London). This machine, rated 120 MW



was built by GEC and is supplied with steam from an 860 klb/hr Foster Wheeler boiler. Bringing into service the fifth AEI (formerly BTH) 60 MW alternator at Plymouth "B" (South Western) completes the 120 MW extension programme for the station. The 550 klb/hr No. 5 boiler is of Babcock and Wilcox manufacture. The third set commissioned by the CEGB during September was No. 10 at Spondon "H" (East Midlands). This is a 10 MW alternator constructed by AEI (formerly MV). No new plant was commissioned by either of the Scottish boards during September, but the NSHEB de-commissioned two small installations at Wick and Thurso with an aggregate capacity of 1.23 MW.

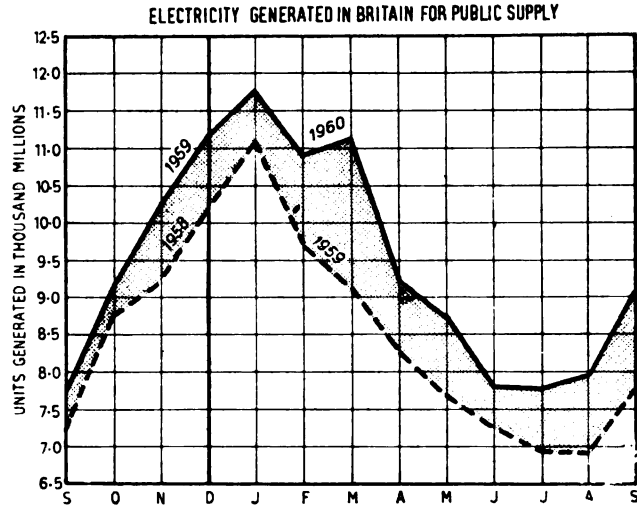
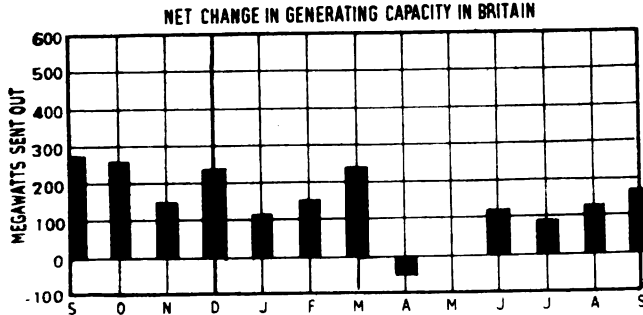
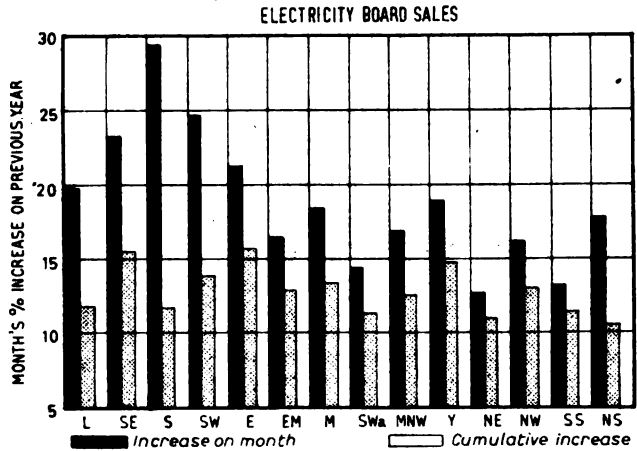
Electricity sent out by the CEGB totalled 7,836 million kWh during September, while for the SSEB and NSHEB the figures were 500 million and 172 million units, respectively. The total of 9,044 million units generated by the three boards includes 169 million units generated by hydro-stations. This represents a 51% increase on hydro-generation in September, 1959.

Total coal consumption by the three boards showed a 21% rise over September 1959 to 3,959,000 tons.

Electricity Board Sales Progress in September

Board	Electricity sent out in millions of units	% increase on Sept. 1959
London	609.3	19.8
South Eastern	465.8	23.2
Southern	648.7	29.5
South Western	301.3	24.7
Eastern	746.8	21.2
East Midlands	650.4	16.4
Midlands	858.3	18.4
South Wales	508.7	14.5
Merseyside and N. Wales	513.7	16.8
Yorkshire	856.0	18.8
North Eastern	488.3	12.7
North Western... ..	830.8	16.2
Direct Supplies by CEGB	311.2	8.5
CEGB Total	7,789.3	18.6
South of Scotland	586.7	13.7
North of Scotland	133.7	17.7

Table excludes area board purchases from other sources



equipment for industry

Standby lamp and dust extractor

HAVING a 36 W bulb mounted in a translucent enclosure, the "Moflash" standby lamp unit is for use in conjunction with 220/250 V mains. Mains failure operates a relay which switches the lamp on to a built-in 6 V accumulator supply. Incorporated in the accumulator circuit is a mains charging unit and a manual control switch having positions: on, off and accumulator recharge. A red pilot lamp indicates when charging is in progress. The unit is of black enamel finished cast aluminium alloy with integral fixing brackets and is weather-proofed.

Under the same trade name is a dust extractor unit intended for clearing heavy dust concentrations from factory atmospheres. Dust-laden air is drawn through a flameproof fabric filter by a 200 cu ft/min motor-driven fan suitable for 400/440 V supplies. The filter can be easily cleaned by means of a device which shakes accumulated dust into a removable collector tray. If required, a special duct can be fitted for discharging noxious dusts to atmosphere. The extractor unit is castor-mounted for mobility. *The Silvasflame Co. Ltd., 218a Monument Rd, Birmingham 16.*

Special finish for aluminium

A SERIES of three patented processes for providing a corrosion-resistant finish on aluminium and its alloys is based on the formation of a thin oxide-chromate surface film. They form "Bonderite" coatings for which certain special advantages are claimed. The coatings provide a good base for paints and similar finishes while being themselves inherently corrosion resistant. Low process time enables application to continuous strip at rates of up to 60 ft/min while excellent tenacity allows subsequent complex forming operations without damage to the coating. *The Pyrene Co. Ltd., Great West Rd, Brentford, Middx.*

Magnetic base bench lamp

SUITABLE for use in workshops or factory assembly, a portable lamp has a magnetic base which provides rigid support when placed on any horizontal or vertical ferromagnetic surface such as provided by a sheet-steel cabinet. Known as the "Magnetic" local lighting unit, the lampholder and hemispherical metal shade are attached to a flexible stem which enables adjustment at any angle. *A. Douglas Co. Ltd., Lancaster Rd, High Wycombe Bucks.*

Transistor tester

DESIGNED for testing transistors, an instrument recently introduced provides a range of seven collector voltages from 1.5 V to 12 V and incorporates a meter reading voltage and current. There are five current ranges on the meter covering 0 to 100 mA up to 0 to 1 A, and a voltage range of 0 to 25 V. Measurements can be made for n-p-n and p-n-p transistors and include collector leakage current, collector/base characteristic and current gain, the latter being obtained by direct reading. Power supply is from an internal battery which can deliver a maximum current of 50 mA. For higher currents up to 1 A, provision is made for connection to an external mains unit or accumulator supply. The instrument should find useful application in development, inspection and maintenance of transistorised equipment, for example in transistor matching. *Bruton Engineering Co. Ltd., Church St, Twickenham, Middlesex.*

Torque gauge

IMPROVED models have been announced of the "Waters" torque gauge. This comprises essentially a collet chuck, accommodating up to $\frac{1}{4}$ in. shaft diameters, integral with a hexagonal body which incorporates a 300° sweep dial. The gauge can be used for measuring static torque developed by

Single or bi-directional
torques up to 40 oz-ins
can be measured with
gauges in the Waters' range

The Bruton transistor tester
provides seven collector
voltages up to 12 V and
measures base currents up
to 1 A



small electric motors or slow-moving torques of units such as potentiometers and variable capacitors. In the case of the latter, readings are taken simply by rotating the unit relative to the gauge body, the shaft being held by the chuck. The dial needle registers maximum torque, accuracy of measurement being $\pm 5\%$ for the standard model. Range of models available covers various requirements such as clockwise, counter-clockwise and bi-directional movements, with calibrations up to 40 oz-in. or its equivalent in gm-cm. With these features the gauge should be useful to those engaged in adjustment or development work of servo-mechanisms and similar equipment. *International Engineering Concessionaires Ltd., 39 Parliament St, S.W.1.*

Ribbon feeder connectors

A RANGE of connectors has been specially developed for use with a new type of cable known as ribbon feeder. Comprising up to 18 copper foil strips in flat formation, insulated and symmetrically spaced, ribbon feeder is intended primarily for flexible interconnection of printed circuits. Feeder connectors consist of 8-way and 18-way plug or socket units having identical plastics housings with snap-on lids. Sockets can be of either free or fixed type. Connections to the feeder are made by threading it through slots in the housing and soldering the ends of the strip conductor to terminals provided. The feeder is effectively gripped by the housing slots, thus preventing the transmission of undue mechanical tension to the terminal joints. Two 6 BA holes in the mouldings enable chassis or panel mounting or, if required, the units can be stacked one upon the other. Connector rating is 3 A per contact at 250 V a.c. or 350 V d.c. *Belling and Lee Ltd., Great Cambridge Rd, Enfield, Middlesex.*



Ribbon feeder connector by Belling and Lee

for the electrical trade

latest in storage heating

Commercial/industrial storage block heater field sees further growth with the "Chandran" range of three models. In appearance they are unobtrusive, the straight-edged outer metal casing being finished in silver grey with chrome-plated guards. They consist of firebrick, insulated with glass wool from the outer casing. On a normal night charging period of ten plus two hours boost, they provide whole day's heat. Automatic time switches the heaters on and off during the charging period, whilst the on of room thermostats control release of hot air during the day. Three models are: 1 kW, 2 kW and 3 kW, all 32½ in. high and 11½ in. deep, widths up to 34½ in. Prices are £10s, £15 10s and £19 10s, respectively.

The guards, which are optional, cost 15s, £1 and £1 5s. *Green Bros. Electricals, 19 Market Pl, Brackley, Northants.*

newer for today's carpet

With in the domestic cleaning field Morphy-Richards' new "Super Suction" model, VCA, designed with the modern carpet in mind. It has a spherical standing container mounted on castors, and costs slightly more than the earlier VBA cleaner.

The slight of the accessories that have been designed for this model is an improvement which, the makers claim, is for cleaning the modern rubber-backed carpet. Since this type of carpet not allow air to pass through it, an alternative source of air intake is necessary.

The new carpet nozzle has a series of ribbed grooves across its side which compensate for the lack of upward flow by drawing air across the tufts, effectively loosening debris in the pile. Another clip-on attachment provides the user with a multi-purpose brush which allows

vacuum cleaning and sweeping in one operation. Other attachments include a crevice nozzle, upholstery nozzle and a soft-maned dusting brush.

The lightweight p.v.c. hose is noteworthy for its swivel-entry cap. This connection allows the hose to be swung into the most convenient position without moving the container. Total reach of the hose and extension rods is 11 ft. A quantity of disposable paper dust-bags and a large detachable cloth dust bag are provided with the appliance.

Loading of the 1 h.p. motor is 750 W. Price £25 4s tax paid. The dust bags are available at 3s for six. *Morphy-Richards, 6 Conduit St, W.I.*

Anglo-American luxury cookers

TWO luxury cookers of remarkable design are the result of a joint effort between John Thompson Instrument Co. and the Tappan Co., of Ohio. John Thompson are to produce the Tappan "400" range of cookers at their Wolverhampton factory and market them under the name "Thompson-Tappan."

The construction of these two units, though novel in comparison with designs familiar in this country, represents the growing American trend of having ovens at eye-level above the cooking-top. Perhaps their most striking feature is the retractable hob, which is slid out of sight at a touch. An impressive panel of controls is placed along the top of the oven in both models, providing seven-position control for the four hotplates and automatic oven timing. Glass doors and concealed oven lighting simplify cooking considerably. The finish of "Lusterloy" and non-porous chromium are said to improve oven baking by reducing radiant heat loss, though all sides are fully insulated. Care has been taken to ensure that cleaning remains as simple as possible. Reflector bowls in the oven units lift out completely and silicone seals above the oven doors are simple to remove and clean. The oven bottoms can be removed completely.

The larger model "442" is 40 in. wide and

Chic pendant

THE stylish "Parisienne" commercial pendant fitting is a good example of the concentric louvre design for single-lamp units. It has a rod suspension and tapered lamp holder cover from which three chains support the circular outer surround. This surround is pattern-pierced with glass rosettes and supports the white inner louvres. The fitting is designed for use with a 200 W or 300 W lamp and finished in imitation brass. Diameter: 18½ in. *Courtney Pope (Electrical), Amhurst Pk Wks, Tottenham.*

Scharpf price cut . . .

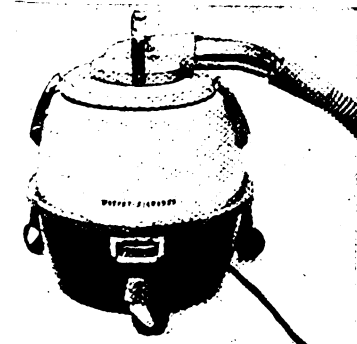
TWO Scharpf spin dryers have been substantially reduced in price. The Rotadry II comes down from £21 to £16 16s tax paid and the Scharpf Rotadry IV from £29 8s to £23 12s 6d tax paid. Credit claims will be accepted on goods supplied after 1 April by the distributors.

. . . and new service arrangements

A further announcement states that beyond 31 Dec. Continuous Viewing Ltd. will no longer service Scharpf machines. Requests for service should be directed to Scharpf Service Div., Denham and Morley Ltd., 173-175 Cleveland St, W.I.

may be wall mounted or placed on a base cabinet. It has two ovens, one of which contains a rotisserie. In this model the four hotplates are placed in a row, with a maplewood cutting board in front of them. This board can be lowered if necessary. To one side of the oven are fitted two socket-outlets ready to take small appliances, one of which is linked with the time controller. The smaller "436" model retains the most important features of "442," though it has only one oven and measures 30 in. in width.

The rating of the large "442" model is 13.3 kW, and sells at £248, whilst model "436" has a total rating of 11.7 kW and sells at £185. *John Thompson Instrument Co., Ettingshall, Wolverhampton.*



M-R "Super Suction" cleaner. £25 4s



"Thompson-Tappan" model "442" has two ovens and slide-away cooking top

The baby's blanket

A COT-SIZED electric blanket is the latest from Pakamac Special Products Ltd., the firm set up by Pakamac recently for producing electrical appliances. The blanket is about 3 ft long and 20 in. wide and consists of a p.v.c.-covered fibroceta blanket printed with amusing animal figures. Available in pink, blue, green or white, the blanket is waterproof and fireproof and will retail under the trade name "Pakatherm" at £2 11s 6d tax paid. *Pakamac Special Products, Moorside Mill, Oldham, Lancs.*



The "Pakatherm" cot-warming blanket of p.v.c. and fibroceta. £2 11s 6d

TRADE PUBLICATIONS

C.A.V.—Four technical leaflets: 24 V generating set for commercial vehicles; advance information on battery powered tanker discharge; fluorescent light, unit type 363; "Safer Night Driving," tail-lamps and stop lamps. C.A.V. Ltd., Acton, W.3.

STAR.—A brochure celebrating the silver jubilee of Star Aluminium Co. Ltd., 97 Penn Rd, Wolverhampton.

LONDEX.—14-page technical brochure on vacuum and pressure switches.

NEGRETTI.—German version of catalogue T44/G Mercury - in - Steel Recording Thermometer. Also catalogue of instruments for use by Indian Industries. Negretti and Zambra, 122 Regent St, W.1.

KELVIN AND HUGHES.—Components Bulletin No 3 giving amendments to catalogue including three new pages and three revised pages.

MOND.—The Nickel Bulletin; 41 - page book August-September Volume 33, No 8-9. The Mond Nickel Co, Thames Hse, Millbank, S.W.1.

INCO-WELD "A." 12-page illustrated technical brochure on a welding electrode and filler wire. Henry Wiggin and Co., Wiggin St, Birmingham 16.

SIEMENS-EDISWAN.—Leaflets on Coventry and Oline ranges of street lamps and timber lamp standards from A.E.I. Ltd., Lamps and Lighting Div., 38 Upper Thames St, E.C.4.

CAMBRIDGE.—New lists of instruments: List 249/2: Extrusion Speed transmitter. Supplement "A" to List 295/1: "Micro-step" precision potentiometer. Temporary list 310: "Numalec" process controller. List 333: CO₂ Recovery and Control. List 331/1: Pneumatic temperature measuring system for use over distances up to 500 ft. List 47/1: Instruments for draught and pressure up to 10,000 lb sq in. Supplement "C" to List 186: "In-Line" scanning recorder up to 400 points. List 62/1: Universal Vibrograph. Cambridge Instrument Co., 13 Grosvenor Pl, S.W.1.

PHILIPS.—Booklet "Lighting Your Home with Philips." 14 pages illustrated text as a counter give-away. Philips Electrical, Century Hse, Shaftesbury Ave, W.C.2.

"THE VITAL LINK."—20-page illustrated brochure produced on the occasion of British Railways electrification conference and exhibition outlining history of carbon brushes. The Morgan Crucible Co., Battersea Church Rd, S.W.11.

IMPALCO.—Leaflet on aluminium roll-welded heat-transfer sheets. Imperial Aluminium Co., PO Box 216, Witton, Birmingham.

STANLEY.—28-page illustrated catalogue No 26 of hand-tools. Stanley Works (Gt. Britain), Rutland Rd, Sheffield 3.

JELTEK.—Leaflet and price list of protective clothing by Jelteck Ltd., Green La, Hounslow, Middx.

The Motor Show

THE 45th International Motor Show opened at Olympia last week. While, of course, chief interest was centred on the main floor where British and foreign cars competed for attention, it was in the galleries that the more important pointers to future developments could be found.

Rectified a.c. Systems

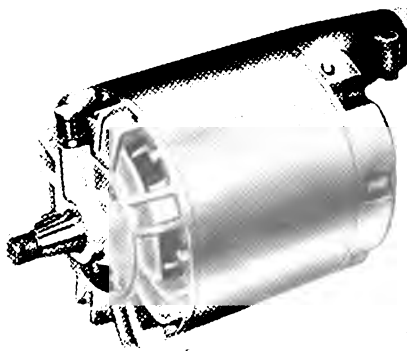
Perhaps the most revolutionary from many points of view was the extension of rectified a.c. generation into the car field. This system has been in use on the smaller two-stroke motor-cycles for years, using a copper-oxide rectifier in conjunction with flywheel generators, but the output of such devices has never been adequate for the family car or larger vehicle. Rectified a.c., using the modern semiconductor rectifiers and transistorised regulators, was first developed for aircraft use and, since the companies making these components were also the major electrical component manufacturers for the car industry, it was inevitable that there should be a move in this direction. The move is now coming.

Lucas and CAV both show a.c. generators which have been developed for automobile use and also for the larger battery charging systems. The Lucas 2AC alternator weighs only 17½ lb yet gives an output of 45 amp at 11,000 r.p.m. The corresponding d.c. machine with an output of 35 amp at 9,000 r.p.m. would weigh over 26 lb. Advantages of

these machines in other directions include the absence of the commutator and better charging at lower speeds, dependent largely on the design of the regulator. By coincidence, a Lucas patent specification on this subject has just been published and is reported on page 641. The Hon Geoffrey Rootes, president of the SMMT, made reference to the development in his opening speech.

Sealed-beam Headlamps

The second development of more than usual interest is the introduction here of the sealed-beam type of headlamp. This has been standard equipment in the States for several years, but it is only in recent times that their production has commenced here. AEI and Lucas are both showing these lamps on their stands.



The CAV. a.c. 24 V generator for battery charging and lighting systems

Engine Tuning

Crypton Equipment Ltd. are showing on their stand the full engine-testing equipment which they have designed for diagnosing loss of performance in car engines without dismantling the engine. A cathode ray oscilloscope with sensing leads clipped over the insulation of the h.t. ignition leads gives pictorial representation of the ignition performance in each cylinder, from which accurate diagnosis of troubles can be made. Other meters check carburation, timing and factors leading to loss of power. Crypton battery chargers include models which enable a flat battery to be fast charged to a point at which the engine can be started after only 15 to 20 sec.

The Exide Press Luncheon

At the Exide Press Luncheon, a regular feature of the Motor Show these days, Mr Edward Powell, sales director, referred to the recent developments in car batteries which had improved considerably both in power-weight ratio and life over the years. He then outlined the position of the lead-plate battery as compared with the alkaline battery and the fuel cell—first made by William Grove in 1840, almost 20 years before Planté introduced the lead-acid cell. Although the fuel cell had a future for battery-driven vehicles, it was still in a distant future. For the present and for car-starting duties, the lead-acid battery would remain supreme for many years to come.

News of the Week

Fair Trading Council To End

All-industry Forum under consideration

An all-electrical industry forum be established to provide a common ground for all sections of the electrical industry when the Electrical Trading Council is wound up on 31 Dec.? This question is before councils of electrical trade associations this week following an exploratory meeting in London at which arguments for and against such a forum were discussed.

In view of the decision to wind-up the EFTC has led to court decisions rigidly interpreting the Restrictive Trade Practices Act to outlaw almost all recommendations for trading procedures. Individual trade associations have had to give up membership of the Council and its schedules of discounts. The ineffectiveness of EFTC through its explicit recognition of the lack of trading ethics, rather than any sanctions it was able to apply. The Council drew its membership from all sections of the industry, manufacturing, wholesaling, contracting and retailing, it provided an opportunity for discussing the particularly electrical aspects of various problems as they arose. At a meeting called by the Chairman of EFTC, Mr T. W. Heather, personal capacity, the possibility of forming some new body in which all parts of the industry could meet for common consultation, which would in no way be restricted under the RTP Act.

The discussion at the meeting showed that on the whole, manufacturers were in favour of the formation of the new forum (though not unanimously); while wholesalers and retailers were for it, but individual manufacturers were unwilling to participate. Those in favour emphasised the urgency of setting up some body before the existing through the Council had passed into memory. They stated that there would be need from time to time to present the "industry" view to governments and other organisations. The idea could be a small organisation with regular quarterly meetings.

Pay rises in cable industry

Increases ranging from 10s 10d per week for men to 8s 6d for women employed in the electric cable making industry, operative from 20 Nov., were agreed at last week's meeting of the Industrial Council. There are proportionate increases for men under 25 of age and for girls under 18. Increases bring the pay for adult male workers in district No. 1 up to classification No. 6, and 18s 4d per week in district No. 2, and up to 13s 6d for females in classification No. 3.

Those who argued against forming a new body thought that all that it could do might be tackled better by direct negotiations between individual trade associations on an *ad hoc* basis. They felt that there would be little appropriate business to occupy a new forum, and that there might be serious difficulty in passing on its conclusions without bringing its operations within the ambit of the RTP Act. However, a spokesman for BEAMA made the limited suggestion that manufacturers might be willing to organise an annual conference of representatives of all sections of the industry tackled on to one of the existing electrical industry conferences, at which general matters might be discussed.

After considerable debate, it was agreed that in effect the meeting should stand adjourned, with the trade associations of the electrical industry letting Mr Heather know whether or not they would be willing to support formation of a committee to look into the practicability of setting up an electrical forum.

Drawback duty on Accessories

THE Treasury have made another Import Duty Drawback Order. This latest, SI No. 1887, provides for the allowance of drawback of import duty paid on the following goods when incorporated into specified lamp adaptors and exports, viz., certain bottle stoppers with screw adaptors, switches, lampholders and plugs. This new Order operated from 25 Oct.

CONTRACTING WAGE RATES

THE new wage rates for mates and other employees in the electrical contracting industry, increased correspondingly on the 1s an hour rise for journeymen (to which we referred on 13 Oct.) have now been finalised. We list alongside the full hourly rates of pay which will operate from 1 Jan. next. In addition, it will be remembered, the overtime rates are being changed together with the rule on special payments. The 42-hour week applies from 1 Nov. next. It should be made clear that these new rates do not apply to Scotland.

SYMBOL REVISION

SIGNS and symbols are being revised by BSI following on six years' experience with use of a BS covering the whole range of scientific and technical work. Meanwhile, some minor changes have been agreed immediately, notably "lbf" for pound-force to distinguish it from "lb," pound mass, and similarly "kgf" and "kg." Further, the full stop has been more rigorously abolished. In future the precise engineer will write such terms as "hp" and "Btu."

Plessey bid for Garrard

THE Plessey Co. Ltd. has made a share-exchange offer for the capital of Garrard Engineering and Manufacturing Co. Plessey offer one 10s Ordinary for every 14 Garrard 1s Ordinary; and six 4½% cumulative second Preference £1 shares for every five Garrard 10s Preferred Ordinary. The offer, valued at over £3½ million, is recommended for acceptance by the Garrard directors who state that although there are indications that the second half of the current year may prove more satisfactory than the first, it is clear that the year as a whole will not be as good as the past year. Under the arrangement it is intended that Garrard should continue as a separate entity under its own board, with Mr Hector Slade as managing director.

LATEST ON VACTRIC

THE receiver and manager of Vactric Ltd. has now announced that the business of selling home appliances—both washing machines and vacuum cleaners—which has been operating at a loss, is being discontinued.

The two subsidiaries, Vactric (Precision Tools) Ltd. and Vactric (Control Equipment) Ltd. have emphasised that they are separate companies from Vactric Ltd. and are both proceeding to trade as usual, and will continue to execute existing contracts without any interruption whatsoever.

Hourly Rates Operative from 1 January, 1961

Journeymen			Mates	
Grade "A" area	6s 6½d	London	5s 4½d	
Mersey District	6s 5d	Mersey	5s 3½d	
Grade "B" area	6s 2d	Elsewhere	5s 1d	
Category I and II Apprentices				
Age	Grades		Mersey District	
	A	B		
15	1s 3½d	1s 3d	1s 3½d	
16	1s 7½d	1s 6½d	1s 7½d	
17	1s 11½d	1s 10d	1s 11½d	
18	2s 1½d	2s 9½d	2s 10½d	
19	3s 1½d	3s 8½d	3s 10d	
20	4s 9d	4s 5d	4s 8d	

Manweb's Tariff Warning

ALTHOUGH the Merseyside and North Wales Electricity Board had a surplus of £1.4 million from operations in the year ended 31 March last, the Board is already considering revising tariffs to take account of increased costs of coal, etc. At last week's meeting of the area Consultative Council, Mr D. H. Kendon, chairman of the Board, explained that the surplus, which came from a revenue of £37 million has to be used to provide the £6 million capital expenditure required. Without it, it might have been necessary to curtail supplies to new estates, or rural electrification, which should not be tolerated.

"The recent wage and salary increases and coal price rise will seriously affect the policy, unless prompt steps are taken to recover the extra costs by increasing tariffs," he stated.

Wage and salary increases will cost nearly £600,000 in a full year, but after allowing for that part chargeable to capital account, about £450,000 must come from the sale of electricity and appliances. The extra cost of electricity due to the rise in the price of coal would be £700,000 in a full year. But some £400,000 of that would be recovered from industry under the coal clauses, leaving the net extra cost to Manweb at £300,000, he went on.

The extra cost to Manweb under the bulk supply tariff coal clause was not yet known, but this problem would shortly be discussed by the Electricity Council. In the meantime, tariffs were under consideration by Manweb and the Council would be advised as soon as there were any concrete proposals to consider, he added.

Morse by Typewriter

AN apparatus enabling anyone without telegraphy experience to transmit morse signals was demonstrated in London recently. Called an Automorse, the device has a keyboard like a typewriter and the corresponding signals are transmitted when a letter is pressed. The Automorse weighs 18 lb and can be easily carried with a transmitter. The inventor, Leif Evensen, of Gothenberg, Sweden, is producing the machine in small volume, but larger-scale production is now planned in Norway. So far, there is no mention of a corresponding device to convert morse signals back into typescript. The long-established teleprinter converts perforations in a tape back into typescript, allowing telecommunication without morse in both directions.

£1.6m increase in S.W.E.B. expenditure in 1961-62

THE South Western Electricity Board have been authorised to spend about £6.7 million next year (1961-62) in extending and improving their distribution network—£1.6 million more than approved for the current year.

This extra sum should enable the Board slightly to increase the rate of rural development, Mr A. N. Irens, chairman of the Board, told members of the area consultative council last week. Furthermore, the prospects for the four years 1962-66 were also improved and they not only hoped to maintain that annual rate of expenditure, but were planning ahead to increase the sum, national economics permitting. This would speed rural development and overall system reinforcement which the Board had been compelled to defer.

In the current year the Board were planning to supply over 1,600 farms.

Mr Irens also claimed that the Board was leading the country in the sales of electrical appliances per 1,000 consumers.

Y.E.B. to use computer for a/cs

THE first electricity board in this country to adopt a centralised electronic computing unit is the Yorkshire Board. They have decided to install an English Electric Co.'s KDP10 electronic data processing system, which will come into operation in about two years' time. The Board made this decision after careful investigation into all available systems of both home and overseas manufacture, it is stated.

The YEB intend to centralise the consumer accounting work of the seven sub-areas, replacing the existing punched card installations. For about half of the working day KDP10 will be employed on the processing of data related to about 25,000 consumer accounts and printing out the bills ready for dispatch. This will include balancing and posting the cash receipts associated with the accounts and automatically producing reminder notices when payment is overdue.

It will also produce up-to-the-minute information from details contained in the consumer records, such as consumption of each class of consumer and statistical analyses.

The YEB, serving over 1½ million consumers, are to set up the system in building to be constructed for the purpose at Scarcroft, Leeds.

At the official opening of the Kincardine power station of the South of Scotland Electricity Board (to which we referred last week), Sir John Pickles, chairman of the Board, is here seen presenting Mr John Henderson, chief engineer, left, to Her Majesty and Prince Philip



G.E.C. Radio/TV Sales Centre

GENERAL ELECTRIC CO. has concentrated radio group activities for Southern and Eastern England at Hammersmith. Previously radio and TV sales, distribution and service were conducted from eight local branches. The re-developed site at Hammersmith has 31,000 sq ft. of floor area and ample parking space. The company's newly developed colour television receiver was demonstrated at the official opening on Friday. Virtually the full range of natural colours was faithfully reproduced and the eye-strain factor seemed considerably less than from watching black and white television.

OFFICIAL PUBLICATIONS

Co-operation between Industry and Education. Industrial Training Council report. 3s.

Import Duty Drawbacks (No. 12) Order, 1960. SI 1887. HMSO (see page 653).

City and Guilds of London Inst.: 1961 General Regulations. Regulations and Syllabuses: 47. Electronic Servicing; 51. Electrical Installation Work; 56. Industrial Radiography; 57. Electrical Technicians' Courses. 1s each.

BS Amendment slips:

480, Pt. 1. Lead or lead-alloy sheathed cables for working vol-

tages up to and including 33 kV. PD 3895; Pt. 2, Aluminium sheathed cables for working voltages up to and including 22 kV, PD 3896; BS 1050, Visual indicator lamps for use in telephone and telegraph switchboards and for allied purposes, PD 3887; BS 1259, Intrinsically safe electrical apparatus and circuits for use in explosive atmospheres, PD 3888; BS 1299, Tumbler-switches and associated switch-plates and switch-boxes, Part 1. 5 A flush-type, PD 3897; BS 2742, Notes on the use of the Ringelmann chart, PD 3901.

Boiler Companies Integrate

HAVING enjoyed close technical liaison for many years past, particularly in the thermal power plant field, International Combustion Ltd. and Simon-Carves Ltd. now announce that the directors of both companies have considered the possibility of even closer association. They have decided that a measure of integration should be effected resulting in greater overall efficiency in operation and wider fields of application. At the same time the individual identity of both organisations will be preserved and existing commitments and association unaltered. This integration of effort applies essentially to the technical fields, and it is not intended that any merging of capital or financial resources should take place.

Wandleside Link in India

WANDLESIDE Cable Works Ltd. is co-operating with an Indian company in a plan to manufacture cables at Bombay. A new factory will be built with capacity to make about 15,000 tons of wires, strips and cables a year. The Indian partner, National Electrical Industries Ltd., of Bombay, which makes transformers and electric motors, will take a considerable proportion of the cable output. National Electrical Industries has paid capital equal to £600,000. A new company, Wandleside-National Conductors Ltd., is being floated on Indian stock exchanges to carry out the cable venture. The cables will be marketed under the Wandleside brand.

G.E.C. buys factory to boost semiconductor output

GENERAL Electric Co. Ltd. has bought a 600,000 sq ft factory near Manchester to provide additional space for the Semiconductor Division. The new factory, to be known as Broadstone Works, will employ 3,000 workpeople and 100 graduate staff within three years, GEC says. The present transistor and semiconductor factory at Hazel Grove employs 1,500 people and this plant will continue in full-scale operation, the company states. Production is expected to start at Broadstone early next year.

Douglas raises tariffs

DOUGLAS Town Council, Isle of Man, have approved proposals for increased electricity tariffs. Only rates unaltered are the flat rate for lighting and prepayment rate for lighting and power. Under the increases in the all-in tariff the primary rate is raised from 1.45d to 1½d p.u. and the secondary rate from 1.16d to 1½d. Similarly, under the flat rate for power, the primary charge goes up from 3.045d to 3½d, secondary rate from 2.175d to 2½d and the final rate from 1.16d to 1½d.



This 1,000 gallon Dunlop collapsible container is used by Yorkshire Electricity Board for oil storage during transformer maintenance. The container above is shown holding about 600 gallons. After maintenance work the oil is pumped back into the transformer through a filter, and the container rolled up as shown (inset.)



OIL
STORAGE
MADE
EASY

SPOTLIGHT ON EUROPE

—McFadzean heads new council

TWO measures to help keep Britain to the fore in export markets were announced by Mr R. Maudling, President of the Board of Trade, during the past week—the creation of an Export Council for Europe, which means a concerted drive in that area, and some extension of the Government's export credit guarantees. Sir William McFadzean, president of the Federation of British Industries, and chairman and managing director of BICC, is now setting up the Export Council for Europe in response to a request from Mr Maudling. The object of the Council is to maintain and develop trade with all European countries.

At the outset at least, the European Council is intended to operate similarly to the successful Dollar Export Council created in the days of dollar shortage; in fact, the two organisations will be neighbours in the City.

But unlike the Dollar Export Council, the Export Council for Europe will not have representatives abroad at this stage. Instead, Sir William McFadzean intends to initiate promotional activities through existing bodies such as joint chambers of commerce in European countries and through British firms abroad and to bring home to British importers the facts and potentialities of the European market. One way in which it is thought the new organisation will be helpful is by arranging for industrialists who are already successful in exporting to Europe to explain their techniques to others.

There was a special problem in Europe, Mr Maudling said, because it was one of the most rapidly developing markets in the world and because of the division between the Six and the Seven "which we all deplore." Mr Maudling said Britain wanted to be in a position to take full benefit of a single European market "as and when it comes about, which I believe will happen and ought to happen."

A number of important bodies have already agreed to sponsor the new Council, including the Federation of British Industries, the Association of

Chambers of Commerce and the TUC.

Industry will be responsible for the direction of the Export Council for Europe but, as in the case of the Dollar Export Council, the Government will provide roughly half the finance and will collaborate to the full. Terms of reference and membership of the Council are to be announced. A committee will probably comprise about ten representatives from sponsoring bodies and about 15 from a wide cross-section of industry.

... Longer Credit

INSURANCE for credit for exports for periods longer than five years will be permitted in future through the Export Credits Guarantee Department when it is shown that there are strong commercial grounds for winning a contract. The lengthened insurance will be offered only where it can be shown that a foreign competitor is offering similar long credit, with the help of an official organisation. Each case will be considered on its merits, and there will be restrictions about the countries to which the extension will apply.

Another change in ECGD practice is to offer part-period cover where there is no official backing for the foreign competitor. In such cases, if the UK exporter needs to offer more than five year's credit to win the order, ECGD will make available cover for the period it would normally have done, with the exporter carrying the risk for the remainder of the longer period. ECGD has not previously been authorised to give such part-period cover.

Towers could improve housing areas

— Landscape Architect

PARLIAMENT should make it easier for the electricity boards to erect lines over private houses and gardens. There was no danger and some housing areas might even be improved by the construction of towers which would give focal points of some scale. For these built-up areas to be sacrosanct at the cost of an open stretch of green country was deplorable. That was the view expressed by Miss Sylvia Crowe in an address to the Institute of Landscape Architects last Friday. She emphasised that the overhead line problem was the most difficult facing the landscape architect today. It was not considered economical to go underground with a cost 13-17 times as great as for o.h. lines.

Each line had to be considered on its merits. But the problem of avoiding air routes, radar stations, radio transmitters, built-up areas and other lines made it increasingly difficult to avoid altogether beauty spots, green belts or precious strips of open country.

More research was needed into insulation problems to make it economically practical for o.h. lines to be undergrounded. A renewed effort was essential, she said; neither electricity nor the landscape were sectional interests; they were national amenities.

With nuclear power stations sited in remote areas, the landscape architect's aim was to push the wild landscape close up to the boundary of a station and not let its influence stray outwards in a suburbia of roads, buildings and embankments. The problems with a coal-fired station were different. Technical develop-

ments in the conventional field were now so rapid that modifications during construction made it impossible to produce a final landscape plan; alternative transmission connections might be needed or new buildings required.

The scale of power stations tended to overpower their surroundings, but landscape treatment must strive to reconcile the disparity in scale, she went on. Miss Crowe also thought that the overhead line structures in substations resembled gallows, while the spike-disintegrated shapes of switchgear and transformers were spread over too great an area.

G.E.C. sells graphite "know-how"

NIPPON DENKYOKU (Nippon Electrode Co.) will pay £50,000 plus royalties to General Electric Co. for the right to manufacture and sell anywhere except in the UK two special types of graphite developed by GEC for use in nuclear plant. GEC will provide technical staff to help the Japanese company build a new plant. Initially for ten years, the agreement is subject to approval by the British and Japanese Governments. One of the graphites is impermeable, on which Nippon Denkyoku will pay 10% royalty; the other has low permeability and royalty is 7½%. These materials could be used outside the nuclear field.

Appliance Development Rumours

VARIOUS rumours concerning new appliances being developed by Hoover Ltd. have been circulating in recent weeks. Although there is no official confirmation of any of these it seems very likely that a new fully automatic washing machine may be the next introduction by that firm.

It may also not be very long before Ada (Halifax) Ltd. provide further news. That concern, control of which was recently acquired by Philips Electrical Industries Ltd., is seeking a design manager "responsible for the design and development of a new range of domestic appliances with particular emphasis on washing machines."

Some 75 members and guests attended the dinner of the Association of Managerial Electrical Executive at Southport last Friday. Seen below are, left to right, Messrs W. J. Forster and R. M. Gravett (both of Manweb), P. H. Flatt and W. C. Parker (N. West, Merseyside and N. Wales Division, CEBG), R. E. Wachter (CEGB) and D. G. Dodds (Manweb)



Plotting Construction Progress



THESE wall charts are used by CEBG's Northern Project Group, Manchester, to record progress of construction of generating stations. A separate chart is used for each station, and the use of coloured indicators enables an instant appraisal to be made of work done on each phase of construction, in relation to schedule. The card index at the side contains detailed information.

Prestcold expands output

PRESTCOLD will soon be a bigger force than ever in the refrigerator market. Finished goods were beginning to flow from the production lines at the new £5 million factory at Swansea, the sales director, Mr D. A. Field, said at the opening of a showroom in Worcester last week. Other appliances would be manufactured at Swansea in due course.

HOME HEATING PLANS

THE sum of £235 was a "small price to pay for contented tenants," Treasurer W. L. Berwick maintained at last week's meeting of Anstruther Town Council. He moved a successful motion that gas and electricity be laid to proposed new houses at Milton Cres, to give tenants freedom of choice. The Council agreed to rescind an earlier decision that the houses should be all-electric.

London County Council Housing Committee have approved a £647,600 second-stage scheme for the development of a site at Rotherhithe New Rd., Bermondsey. This includes another 16-storey block of flats and three four-storey maisonnette blocks, all with electric floor-warming. The high block will have two high-speed lifts.

Ripon-Pateley Bridge Rural Council are considering the form of heating to be installed in "special accommodation" to be erected at Station Sq. Patel Bridge. Representatives of the Northern Eastern Gas Board demonstrated gas space-heating units to the Housing Committee, who agreed that either gas or electric heating, other than floor-warming, should be installed, and the architect Mr J. C. Kenyon, was asked to obtain details and quotations for suitable electrically heated systems.

Perth's multi-storey flats to be built at Potterhill will be electrically heated, similar to those at Pomarium, the Council's Housing Committee has decided after considering a letter from the Scottish Gas Board.

Automation in the Steel Industry

THE first step towards automation in any industry is full instrumentation of plant involved. This was emphasised by Lord Halsbury, opening a recent conference at Buxton, on the application of automation to the iron and steel industry. Organised by the British Iron and Steel Research Association to stimulate general interest in this subject, the conference was attended mainly by delegates from the steel industry. Also represented were firms concerned with instrumentation and control, and other industries and research organisations interested in automation techniques.

It was explained at the conference that by means of instrumentation complete data was obtainable to formulate operating rules necessary for "on line" computers used in controlling individual stages of a production process. Before automation could be applied to the process as a whole, careful study was required to understand its logic and to

assess economic aspects. In terms of the steel industry, it was pointed out that there was extensive instrumentation of many steelworks processes today which could thus be adapted to computer control. Examples were blast and open-hearth furnaces, cold- and hot-strip mills. A degree of automation had already been applied in these instances, such as width measurement and correction of hot strip. There were, however, still some difficult problems to be solved, particularly in respect of quality control arising out of lack of suitable instrumentation. There was, for instance, no known reliable method of continuous furnace melt analysis.

New constitution for automation body

THE British Conference on Automation and Computation which, since its formation in 1957, has been divided into three autonomous groups—broadly automation, computation and sociology—this month merged the groups under a central council, with management in the hands of an executive committee. However, the 31 member organisations will continue to act individually as well as jointly to foster progress in the fields of automatic control and computation. Under the new arrangement, BCAC will act as a clearing house for information on the relevant activities of members (of which the Institution of Electrical Engineers is one). The information will continue to be published in the BCAC Bulletin. At a meeting on 10 Oct. Sir Walter Puckey was elected chairman, and Mr W. K. Brasher (secretary of the IEE) was elected honorary secretary.

I.E.C. talks meters

INTEGRATING meters and indicating instruments were up for discussion at a meeting of the International Electrotechnical Commission measuring instruments committee held in Paris recently. As a result of decisions taken, a draft is to be circulated of recommendations on reactive voltampere meters while another will deal with terminal markings for indicating instruments. Clearance was given for publication of recommendations dealing with watt-hour meters. There was intensive argument about direct-writing slow-response recording instruments and a working group was set up in an attempt to produce an agreed solution. One of the sub-committees began consideration of recommendations on signal generators but did not complete its work.

Weybridge-Chessington Line

LAST of the objections to the route of the proposed 275 kV transmission line from West Weybridge to Chessington were heard at a public inquiry at Cobham recently. Total length of the line is to be ten miles and wayleaves for all but four sections totalling half a mile have been obtained by the CEBG. The disputed half-mile concerns properties at Esher, Cobham, Walton and Weybridge, and Byfleet.

Automation factory expands

WORK will start immediately on expansion of the Lanarkshire automation equipment factory of Honeywell Controls Ltd., a wholly owned subsidiary of Minneapolis-Honeywell Regulator Co., of the US. Mr C. W. Spangle, managing director of Honeywell Controls, said this week that the Board of Trade would finance the building, which would increase floor space at Motherwell from 190,000 sq ft to 350,000 sq ft and cost about £500,000, and Honeywell would spend at least as much again on plant.

LARGE ORDERS RECEIVED

FOUR 75 MVA three-phase transformers have been ordered from Associated Electrical Industries by the CEBG for Templeborough substation to step down the 275 kV supergrid voltage giving a 33 kV supply to six 40 MVA arc-furnace transformers to be installed by Steel, Peech and Tozer. The AEI transmission transformers will be of the outdoor oil-filled type with natural cooling up to 50% loading and forced-oil circulation and air-blast cooling for higher loadings.

SWITCHGEAR for extensions to CEBG power stations at Aberthaw and Swansea North has been ordered from AEI switchgear division. For Aberthaw, seven 132 kV, 3,500 MVA indoor air-blast breakers and control equipment are involved, together with three 6.6 kV, 250 MVA metalclad auxiliaries switchboards and associated relay panels. Total value of the order is £300,000. The Swansea order covers development of two existing transformer feeders into a

ten-switch double-busbar substation and nine 132 kV, 3,500 MVA oil circuit-breakers and ancillary equipment are involved in a £250,000 order.

SIX switchboards and 25 local control panels now being made at the Blackwood Works of South Wales Switchgear Ltd. are for export to Rumania. The equipment, of which the switchboards are 6.6 kV, 250 MVA single-busbar air-insulated design, will be used for process motor control in a Kraft bag plant being supplied by Lyddon and Co. The contract is valued at £35,000.

A CENTRIFUGAL blower of 100,000 c.f.m. capacity, for delivering air to blast furnaces, has been ordered from GEC by Dorman Long (Steel) Ltd. To be installed at Cleveland, the blower will be driven by a direct-coupled steam turbine supplied at 425 lb/sq in., 725°F. Value of the order is £139,000. Condensing plant is to be supplied by Mirrieles Watson Ltd., of Glasgow.

A £950 Dexion Glidewheel gravity conveyor system for cartons and packing paper just installed at the Wembley works of Berry's Electric Ltd. The installation is suspended from the roof trusses on slotted angle structure, leaving clear floor space. Cartons are now made up in a first-floor store and fed on to two main assembly lines and take two right-angle turns before entering the final sections



N. Scotland island problem

WITHOUT Government aid there is no hope whatever of either Barra or North Uist getting a supply of electricity in the next five years, Lord Strathclyde, chairman of the North of Scotland Hydro-Electric Board, told local Council representatives at a meeting in Inverness earlier this month. He thought it extremely unlikely that they might get a supply in ten years, but it might be given in 15 years, was the only hope he could offer. Cost to supply Barra, by submarine cable, had been estimated at £262,000. To supply North Uist would cost £700,000, it was stated.

After subsequent discussion on hydro-electric schemes, including the Nevis project, Lord Strathclyde pointed out that since the Board had been in existence it had brought electricity to 102,000 rural consumers and the loss the Board was carrying today as a result of those connections was £1,604,400. They could only carry that loss by making a profit on any electricity sold to the south.

Permanent home for Royal Show?

THE Royal Agricultural Society are negotiating to lease from Lord Leigh a site for a permanent base for the Royal Show at Stoneleigh Abbey, near Kenilworth, Warwickshire. The site, about 500 acres, is some five miles south of Coventry and ten miles to the east of the M1. The lease will cover an initial period of seven years and it is expected that the site will be ready for the first show to be held there in 1963, following the 1961 show at Cambridge and the 1962 show at Newcastle upon Tyne.

For some time now, the Society has been seeking a permanent home for the show in the Midlands instead of the more expensive system whereby the show is staged in different parts of the country each year.

Sayings OF THE WEEK

"There is something essentially brutal in the 'breaking' of a circuit. Although it works, it does not seem the right way." . . . Mr J. E. L. ROBINSON, in his chairman's address to the IEE Supply Section.

"It is unfortunate that the surplus hangs down like a ripe cherry from a tree, which just needs picking." . . . COUNCILLOR W. L. WILLIAMS, in discussion on tariffs at Merseyside and North Wales Electricity Consultative Council meeting.

"Some people say we are scraping the bottom of the barrel. I do not agree. I think the barrel has a false bottom and there is a lot of good stuff still in it." . . . SIR PATRICK LINSTEAD, rector of Imperial College, UL, speaking of the plan to double the university population over four years.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Tuesday, October 25					
	£ per ton	Weekly change		£ per ton	Weekly change
COPPER, standard class A (settlement) ...	220½	-2	ZINC, virgin, min. 98% purity (cash) ...	88½	+½
" (3 months) ...	222	-2	" (3 months) ...	86½	+½
LEAD, refined pig. 99.97% purity (cash) ...	68	+½	RUBBER, per lb No. 1, RSS, spot c.i.f. basis, ports. Dec. ...	28½d	-½d
" (3 months) ...	69	+½	" c.i.f. basis, ports. Dec. ...	27½d	-
TIN, refined, min. 99.75% purity (settlement) ...	801	-8	ARMOURING: Galv. Steel Wire (0.104 in.) ...	66½	-
" (3 months) ...	796	-2	" Mild Steel Tape (0.04 x 1½ in.) ...	53½	-
ALUMINIUM, ingots 99.995% ...	186	-	NICKEL (home) ...	600	-
" wire bars (4 x 4 x 54") ...	193½	-	MERCURY (76 lb flask) ...	70½	+½
BRASS Strip 63/37 ...	197½	-3½	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	-
SILVER (Troy oz) ...	79½d	-	Lead. (New York) ...	12c	-

* Tape Price, now an average, includes varnishing

Standard Lamp Life

WHETHER the nominal life of 1,000 hr is the right value for a British Standard is discussed in the October issue of *BSI News*. BS 161, Tungsten Filament Lamps for General Lighting Service, specifies this life, but a question has been raised whether it should be extended in view of improved manufacturing techniques. The BSI committee responsible for this and other lighting standards is quoted as saying that the figure aims to give the user light at the lowest overall cost presupposing normal operating conditions, freedom from vibration and shock. Lamps complying with BS 161 are found on test to give an average life greater than the minimum 1,000 hr; where unusual conditions are present, they are best made by use of lamps of

the next higher standard voltage than the declared value of the electricity supply. There is warning, however, that such a step is only economical in special cases, as extension of life can be obtained only at the expense of lamp efficiency and, hence, reduce light output. The hard fact is that full lamp life and light output per watt are inseparably determined by filament working temperature.

News in Brief

The first of four 120 MW turbo-generators at Skelton Grange "B" power station was commissioned last Friday.

HRH Prince Philip has been invited to officially open Belfast's new power station. On 1 Nov. next the Princess Royal is to open the Coolkeeragh power station of the Electricity Board for N. Ireland.

The GEC have prepared a 16 mm sound film in colour of the soil-warming cable installation at Murrayfield, which is available for free loan.

Queen's University, Belfast, have ordered a Deuce computing system from English Electric for the Applied Mathematics Dept.'s plan to expand into space research.

BSI have started work on a standard method of test for resistance per unit length of metallic electrical resistance material. A draft has been prepared based on BS 3239, the corresponding standard for conductor materials.

Last Tuesday Lady Nelson officially opened the new headquarters of the English Electric Group (which we described on 1 Sept.).

In our reference to Kincardine generating station in 13 Oct. issue we referred, in error, to auxiliary transformers supplied by Watford Electric. They were, in fact, supplied by Transformers (Watford) Ltd.

Thermair Domestic Appliances Ltd. announce that they have discontinued production of their "Saturn" spin dryer.

Export prospects good

BRITAIN'S export prospects remain good for the final quarter of 1960, according to General Electric Co.'s economic and marketing research unit. Ceylon, USA and Venezuela are the only countries in which the outlook is deteriorating, with the proviso that the newly independent states of British Africa may not be such safe markets as in the past. Prospects are considered to be improving in Argentina, France, Iraq, Malaya and Portugal.

One cloud on the horizon is the speeding up of moves by the Six towards a common external tariff which, the survey says, would entail very serious discrimination against outsiders. The survey clearly favours acceptance by Britain of the principles of the Rome treaty, which is not surprising as Britain's exports to other countries in the Seven are still only two-thirds of her exports to the Six. Conditions for a rapprochement with the Six are more favourable than for months, because of acceptance of the need for Western Unity and because Dr Adenauer and President de Gaulle appear to have agreed that political integration of the Six should not be pursued—but time may be running out, the survey states.

Company Activities

IS the Stock Market now moving in anticipation of some easing of the "squeeze"? The fact that private investment buying as well as that of the Institutions continues to underpin the market despite the worsening of the sales position with the motor industry and the majority of domestic appliance suppliers, suggests that this might be the case. It is true that last week Mr Selwyn Lloyd, Chancellor of the Exchequer, gave the Treasury view that it is "too soon to talk of demand becoming insufficient" and again repeated his Scarborough decision that the credit curbs would be eased as soon as it was thought safe to do so in the interests of the economy as a whole. The emphasis is on the last three words. But apart from the general clamour which is now growing to ease the squeeze, the Chancellor has before him the conclusions of the latest Federation of British Industries industrial questionnaire (to which we referred last week). Belief, therefore, grows that where the maximum repayment period on H.P. contracts is to two years there may soon be an extension to three.

Then there is the question of Bank rate. Following the recent French reduction and the continuing outflow of gold from low interest rate USA, City

opinion is that both W. Germany and the UK will not be long in following with cuts. This then was the background to a firm if unexciting industrial market.

Electrical shares for the most part saw very little activity although there were a number of useful exceptions. AEI starting out the week at 43s 3d dropped to a new 1960 "low" of 42s 3d but recovered to 42s 9d following investment buying. English Electric showed greater strength at 34s 3d, a rise of 1s 9d. Parsons were 2s a share dearer at 46s, while "twin" Reyrolle went 2s 9d better at 36s. Birmingham Sound Reproducers were in demand at 51s to show a gain of 2s 6d on the week, and Decca on further consideration of the report spun up another 1s 9d to 49s. But Reliance-Clifton Cables on the increase in the interim dividend from 6% to 8% jumped 1s 9d to 26s 6d. According to the chairman, present indications are that 1960 results will not fall substantially below those of 1959, and if earnings hold the company expects the current year to provide ample cover for an increase in the final dividend. Vactric Ordinary although up at one time to 8s 1½d on the possibility of an offer by Longford Electric once more weakened to 6s 3d, while Crabtree Electric came back further to 33s after 34s.—*From our City Correspondent.*

Perak River H-E Power Co.

The marked improvement in results followed the progressive relaxation of restrictions and, since 1 Oct. last, all restrictions on the export of tin have been removed. Mr H. G. Balfour, the chairman, reports that the company's monthly returns to date are running at a very satisfactory level and he anticipates results at least as good as for 1959-60 in the absence of adverse outside factors. In the year to 30 July last, the Chenderoh power station generated 170.8 million units—an increase of 20%—and the Malim Nawar steam station (where two new 12 MW sets were in-

Year to 31 July	£ Gross Revenue	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	1,618,470	287,910	20	10	17/6	13/7
1957	1,683,155	400,745	29	12½	18/3	13/3
1958	1,456,268	286,966	20	10	16/1	13/1
1959	1,044,202	70,161	2	5	18/1	12/3
1960	1,502,688	295,051	22	15	21/-	14/9

stalled) supplied 180.6 million units, 97.8% more than in the previous year. The Batu Gajah station provided a further 35.1 million units. The company is examining the possibility of taking a bulk supply from the CEB of Malaya, and is also considering installing further generating plant at Malim Nawar. The subsidiary company, Kinta Electrical Distribution Co., which supplies 71 towns, villages and other centres, sold 19.3 million units, an increase of 5.45%.

Parkinson Cowan Ltd.

Announcing an interim dividend of 5%, the directors warn that the final will be much influenced by the state of business next spring, but is likely to be lower than last year. Hire-purchase restrictions have severely reduced domestic appliance sales, but trading in the meter and instrument activities is better than last year, but not by a sufficient margin to offset a most disagreeable but it is believed only temporary reversal of fortune on the appliances side. The business of Bastian and Allen was recently acquired.

Reliance-Clifton Cables and Industrial Products

Announcing an increase in the interim dividend from 6% to 8%, the directors state that prices in the cable-making industry have now regained some measure of stability, but the level over a wide range of products remains uneconomic. The effect of smaller profit margins in the earlier part of the year is now being offset by increased output. They expect the results for the current year should not fall substantially below 1959, and if this estimate is fulfilled there would be ample cover for an increase in the final dividend (9% plus 5% capital profits distribution last time).

Dividends Declared

T. Clarke & Co. Interim 8% (same).
E. Green & Son. Interim 5% (same), but the chairman warns that production and profit will be appreciably below the 1959 figures.
Allen West & Co. Interim 5% (same).

Sydney S. Bird and Sons

Warning that no dividend is likely for the current year has now been given by the directors. The company had a very adverse trading period for the first nine months of the year, resulting in a trading loss. Reorganisation has been carried out and by the end of September the position was stabilised and it is anticipated that the company will trade at a profit for the remainder of the year.

Burco Dean Ltd.

Dealings will probably start today in the £450,000 of 6½% unsecured loan stock 1980-85, all of which was subscribed for by Charterhouse Finance Corporation at £93, to which we referred on 15 Sept. A fair amount is expected to be available at £93½.

Calcutta Electric Supply Corpn.

An annual outlay of not less than £1½ million on reinforcement of the transmission and distribution systems is anticipated over the next four years. Sir Harry Burn, chairman, tells shareholders. The board have deemed it advisable to appropriate £575,000 from the accounts for plant expansion and replacements. Capital expenditure in the year ended 31 March last amounted to £1,160,000. Although gross revenue in that year increased, the clear profit falls short of the reasonable return to which the company is entitled by £67,353, which has

been made good by a similar transfer from special reserve.

East African Power and Lighting

Concerning our note on 11 Aug. on the acquisition by this concern of the Nyeri electricity undertaking, we should make it clear that the company only issued to the Government of Kenya £50,000 worth of unissued 7% preference shares and £150,000 of Ordinary stock. Mr A. J. Don Small, the chairman, also stated that minor valuations and the acquisition of stocks and stores were covered by an additional payment of some £21,000. There was no other cash payment.

Holophane Ltd.

An increase in the volume of business handled resulted in the improved trading profit figure despite the maintenance of stable prices for the company's products

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	139,224	55,716	65	30	21/9	16/9
1957	143,615	56,399	65	37½*	16/1	11/1
1958	121,576	49,338	34	22½	15/10	12/7
1959	106,001	49,189	32	26	21/-	12/9
1960	113,537	52,771	34	30	22/3	16/1

* Plus 66½% capital bonus.

even though cost of materials and operating expenses continued to rise, the directors report. The value of orders outstanding has also increased and the level of overseas business has improved.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

28 Oct.—Manchester C.C. Electrical installation in smoke chamber, Central Fire Station.—See 20 Oct. issue.

29 Oct.—Dagenham B.C. Applications invited for inclusion in approved list of contractors for school maintenance electrical work.—See 20 Oct. issue.

29 Oct.—Heston and Isleworth B.C. Rewiring, supply and fixing of power outlets in: Contract 1, 92 houses; Contract 2, 102 houses; and Contract 3, 105 houses on Worples estate, Isleworth.—Advertised 13 Oct. issue.

31 Oct.—Dumfries B.C. Electrical installations in traditional houses, Lochside fifth development, section 7-93. Applications to Town Clerk, G. D. Grant, Municipal Chambers, by above date.

31 Oct.—Edinburgh (d) Electrical installation, switchgear and distribution system; (e) lift installation in Dept. of Clinical Medicine and Medical Physics, Royal Infirmary. Secretary, S.E. Regional Hospital Board, Scotland, 11 Drumsheugh Gdns, Edinburgh 3. Applications by above date.

31 Oct.—Leighton Buzzard U.D.C. Erection of 28 Group "A" Stanton columns complete with lanterns/gear along A4012; resiting including the provision of new lanterns of 17 Group "B" columns and the erection of 33 additional Stanton columns/lanterns along Stanbridge Rd.—See 13 Oct. issue.

31 Oct.—Oldham C.B. Conversion of 15 mechanical public clocks to electric drive or electric wind.—Advertised 29 Sept. issue.

31 Oct.—Taunton B.C. Supply of (Item d) electrical goods for year.—See 20 Oct. issue.

31 Oct.—Warrington B.C. Contract 1. Supply and erection of submersible well pumps, horizontal centrifugal pumps, switchgear and hydraulic instruments for Houghton Green. Contract 2. Small horizontal centrifugal pumps, etc., for Risley Pumping Station.—See 20 Oct. issue.

31 Oct.—Wrexham B.C. (a) Electrical installations in 40 dwellings. Tanat Way and Sutton Drive; (b) supply of consumers' units and cabinets.—See 20 Oct. issue.

1 Nov.—Harrow B.C. Supply and installation of 120 200 W sodium units on 30 ft steel columns and removal of existing installation along Edgware Rd, A5.—Advertised 20 Oct. issue.

1 Nov.—North Down R.D.C. (a) Supply and erection of fluorescent street lighting in 15 villages.—See 20 Oct. issue.

1 Nov.—Watford B.C. Electrical installation, including embedded floor heating in 20 elderly persons' flats (one three storey block). Applications to Borough Engineer, Town Hall, by above date. Deposit £2 2s.—Advertised in this issue.

1 Nov.—Wombwell U.D.C. Supply of 250 3 cu ft 240 V refrigerators in quantities of not less than 50.—See 20 Oct. issue.

3 Nov.—Newcastle upon Tyne C.C. (1) Electrical installation in further extensions and alterations at Heaton Grammar and High Schools. Applications to City Architect, 18 Cloth Market, by above date.

3 Nov.—Sunderland B.C. Supply of gas and electric cooking equipment for Bede Grammar School. Central Purchasing Dept., Hylton Rd.

4 Nov.—Down C.C. All-electric lighting and heating installation in Child Health and Welfare Clinic, Knockree Ave, Kilkeel.—See 13 Oct. issue.

4 Nov.—Dunbarton C.C. Supply of Gp "B" tubular steel columns. Applications to County Lighting Superintendent, W. Arthur, 24 George Sq, Glasgow C.2, by above date.

4 Nov.—Oldbury B.C. Erection, on fixed-price basis, of 88 Class "B" concrete

columns, supply and fitting of post-top lanterns with lamps, control gear/time switches, plus resiting of 26 units and conversion to MBF/U operation along various roads.—See 20 Oct. issue.

5 Nov.—Longbenton U.D.C. Supply and erection of 64 sodium units and 474 post-top lantern filament Group 11 street lighting units.—See 20 Oct. issue.

5 Nov.—Middlewich U.D.C. Fluorescent lighting installation in (part) Victoria bldg, Lewin St.—See 20 Oct. issue.

5 Nov.—New Windsor B.C. Supply of (Item 15) lamps and (Item 21) fittings and cable for year to 31 Dec., 1961.—See 6 Oct. issue.

7 Nov.—Aldershot B.C. Supply and erection of Group "A" 25 ft steel columns with 140 W sodium lighting along Lower Farnham Rd and Group "B" 15 ft steel columns and 60 W sodium lighting along Church La West/Ayling Hill. Borough Engineer and Surveyor, Town Hall. Deposit £1 1s.

7 Nov.—Bath C.C. Supply of 200 Stanton 10F spun concrete columns. City Engineer, Guildhall.

7 Nov.—Belfast C.C. Electrical work in alterations and renovation at Falls Rd Public Baths. Details from architects, W. H. McAlister and Ptnrs, 6 Donegall Rd, Belfast 12. Deposit £3 3s.

7 Nov.—East Suffolk C.C. Street lighting included in Contract No. 36 for making up of 247 yd private road. County Surveyor, County Hall, Ipswich. Deposit £2 2s.

7 Nov.—Manchester C.C. Contract 323. Electrical installations: 12 flats, two shops and ten garages, Greenwood Rd. Director of Hsg, Town Hall, Manchester 2.—Advertised in this issue.

7 Nov.—Swanage U.D.C. Electrical installation in new depot at King's Rd West.—See 20 Oct. issue.

9 Nov.—Cheadle and Gatley U.D.C. Supply and erection of 30 Gp "A" pre-stressed concrete columns with 400 W mercury vapour lanterns in Bird Hall La. Engineer and Surveyor, Town Hall, Cheadle. Deposit £2 2s.

9 Nov.—Chelmsford B.C. (c) Electrical installation in new livestock market, Victoria Rd. Borough Engineer, Coval La. Deposit £2 2s.

10 Nov.—Derby B.C. Supply of 49 200 W sodium discharge units on 35 ft steel columns for A5111 Raynesway Trunk Rd lighting. Borough Engineer and Surveyor, Council Hse, Corp'n St.—Advertised in this issue.

10 Nov.—Northwich R.D.C. Supply and installation of 40 Group "A" concrete

columns with sodium lamps/lanterns/gear.—See 20 Oct. issue.

10 Nov.—Suffolk and Ipswich Fire Authority. Electrical work at Colchester Rd Fire Station. Applications to architects, Slater and Haward, 32 Foundation St, Ipswich, by above date.—Advertised in this issue.

11 Nov.—New Windsor. Electrical installations in two maisonnettes at Clewer New Town.—See 13 Oct. issue.

11 Nov.—Oldbury B.C. Erection, on fixed-price basis, of 20 Class "B" concrete columns, supply and fitting of post-top lanterns/lamps, control gear/time switches on Lion Farm estate.—See 20 Oct. issue.

11 Nov.—Wrexham B.C. Supply and erection, on fixed price basis, of ten 25 ft fluted steel columns, brackets and 140 W sodium vapour lanterns lamps for A483 (part) lighting. Borough Engineer and Surveyor, 31 Chester St.—Advertised in this issue.

14 Nov.—Malvern U.D.C. Erection of 151 concrete columns and lanterns plus provision of wiring lamps on seven new estates together with the removal of four gas lighting columns. Surveyor and Water Engineer, C. C. Judson, Council Hse. Deposit £2 2s.

14 Nov.—N.A.T.O. Infrastructure. Provision and proving of a very low-frequency radio-telegraph transmitting station in North of England.—Advertised 13 Oct. issue.

14 Nov.—West Riding C.C. Changeover from d.c. to a.c., by contractors on N.I.C.E.I.C. roll, at Beech Towers, Staincliffe, Dewsbury. Divisional Architect, Bishopgarth, Westfield Rd, Wakefield.

15 Nov.—Whaley Bridge U.D.C. Supply and erection complete of 16 Class "A" concrete columns with sodium lighting. Surveyor, Council Offices, Whaley Bridge, near Stockport.

16 Nov.—Ipswich B.C. Electrical installation in proposed 56-person aged people's home, Chantry estate.—See 20 Oct. issue.

17 Nov.—Belfast C.C. Electrical installation in Assembly Hall, Dunkeld Gdns Model Secondary School for Girls. City Architect, 40 Academy St, Belfast 1.

17 Nov.—Birmingham C.C. Socket-outlet installations and lighting installation repairs in 250 houses at Acock's Green.—See 20 Oct. issue.

17 Nov.—Fylde Water Board. Supply of flow recorder panel and hydraulic measuring equipment.—Advertised 13 Oct. issue.

30 Nov.—Tottenham B.C. Supply of item 3, lamps for year from 1 April, 1961. Applications to Town Clerk, M. L. Taylor, Town Hall, N.15, by above date enclosing large (4) s.a.e.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 103 queries answered this week

Sunvic Controls Ltd.—address for? L.E.C.—Crown Hse, Aldwych, W.C.2.

"Whippet" drink mixers—makers of? C.O.M.—Howard Foss Ltd., Belvedere Wks, Totton, Southampton.

"Clix" accessories—makers of? T.E.—Associated Electrical Industries Ltd., 155 Charing Cross Rd, W.C.2.

J.P. Tubular heaters—address for spares? E.B.—Aurora Factory, Old Kilpatrick, Glasgow.

"Heddo" insulating tapes in P.V.C.—makers of? W.W.—Heddeson Ltd., Heddonia Hse, 374 Euston Rd, N.W.1.

"Hotlock" heated food trolleys—makers of? C.J.B.—Food Conveyors Ltd., 18 Manor Rd, North Hinchley Wood, Surrey.

"Rantact" busbar systems—makers of? G.L.—The Donovan Electrical Co. Ltd., 70-82 Granville St, Birmingham 1.

"Spiromic" heating elements—makers of? T.C.C.—A. and R. Electric Co Ltd., 1 Bruce Ave, Shepperton, Middx.

ANSWER WANTED
"Flux link" hermetically sealed, magnetically operated micro switches—makers of? E.E.L.

—**Matlock U.D.C.** Supply and installation of nine sewage pumps at pumping stations in Darley Vale.—See issue.

ite stated.—**N. of Scotland H.E.B.**, transformer for Persley substation, n.—Advertised 13 Oct. issue.

e stated.—**St. Faith's and Aylsham** Supply of columns, lanterns, lamps and auxiliary equipment.—See 13 Oct. issue.

. . and Overseas

of items marked * may be obtained on application to the Board of Trade, 15, Theobalds Rd, W.C.1, quoting reference.

—**Australia.** Four 500 kVA and two 16 kV/436 V transformers and

two 750 kVA, 33 kV/436 V station transformers with fuse-switch attachments for Sydney South and Dapto substations. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/26808/60) and (ESB/26184/60).*

8 Nov.—**New Zealand.** (1) 150 MVA, 11 kV 3 ph. metal-clad switchgear comprising one incoming c.b. and three feeder c.b.'s. (2) Control, indicating and relaying equipment. One 5 MVA 33/11 kV 3 ph. transformer. Engineer-Manager, Franklin Electric Power Board, Private Bag, Pukekohe. B.o.T. (ESB/26432 and 3/60).*

9 Nov.—**Iraq.** Plastic insulated copper telephone cable (seven items), fixing nails, eyebolts and clamps. President, Central Foreign Purchasing Board, Ministry of Finance, Baghdad. B.o.T. (ESB/27129/60).*

15 Nov.—**Canada.** 1,700 steel transmission line structures. Purchasing Agent, A. C. Wignmore, Saskatchewan Power Corp., 1739 Cornwall St, Regina. B.o.T. (ESB/26643/60).*

15 Nov.—**Colombia.** Nine 30 kW, 12 10 kW: one each of 100 and 200 kW diesel generators. Secretaria General de la Empresa Colombiana de Aerodromos, Calle 26 No. 14/41, Bogota. B.o.T. (ESB/26404/60).*

16 Nov.—**Uruguay.** Three items Neoprene or polyethylene insulated cable. Admin. General de las Usinas Electricas y los Telefonos del Estado, Montevideo. B.o.T. (ESB/27105/60).*

21 Nov.—**Iraq.** 30, 50 and 100 kVA transformers. Director of Contracts Section, Ministry of Defence Directorate of Contracts and Purchases, Baghdad. B.o.T. (ESB/27129/60).*

26 Nov.—**Iran.** 2,600 metres 6 kV cable. Purchasing Dept. (Tender Section), Ministry of Roads, Iranian State Railways, Tehran. B.o.T. (ESB/27802/60).*

30 Nov.—**Iraq.** 26 items, battery components. Ministry of Defence, Baghdad. B.o.T. (ESB/27128/60).*

2 Dec.—**Australia.** Two 30 MVA 3 ph. transformers. Town Clerk, Brisbane City Council, City Hall. B.o.T. (ESB/26962/60).*

5 Dec.—**Australia.** Control boards, communications desks and other control consoles. E.C. of N.S.W., Box 5257, Sydney. B.o.T. (ESB/27670/60).*

7 Dec.—**Sudan.** One 7.5 kW 230 V d.c. generator. Controller of Stores, Sudan Railways, Atbara. B.o.T. (ESB/27676/60).*

5 Dec.—**Iran.** Power plant for Meshed including: boilers, generators, cooling equipment, turbine house crane, evaporators, station pipework, electrical equipment and cables and civil works. Meshed Electric Supply Co., Meshed. B.o.T. (ESB/27104/60).*

13 Dec.—**Colombia.** 30 MW power station near Tocancipa. Empresa de Energia Electrica de Bogota, Bogota. B.o.T. (ESB/26927/60).*

27 Dec.—**Ceylon.** Construction of 33 kV transmission lines. Electrical Engineer, Contracts and Supplies, McCallum Rd, Colombo. B.o.T. (ESB/26492/60).*

30 Dec.—**India.** One 150,000 lb/hr water tube boiler, 925 p.s.i. gauge at 925°F for Basin Bridge Power Station, Madras. Superintending Engineer, Technical (Electrical) Madras S.E.B., 157 Mount Rd, Madras. B.o.T. (ESB/27189/60).*

2 Jan.—**India.** 132 kV single circuit transmission line Jhansi/Kanpur. Superintending Engineer, Engineering Construction, Cerole 23-B, Vidhan Sabha Marg, Lucknow. B.o.T. (ESB/26484/60).*

4 Jan., 1961.—**Costa Rica.** Switches, lightning arresters, meters, insulators, cables, etc., for La Colima diesel station extension. La Proveduria, Instituto Costarricense de Electricidad, San Jose. B.o.T. (ESB/26624/60).*

5 Jan.—**Costa Rica.** One 10 MVA 3 ph. transformer. Instituto Costarricense de Electricidad, San Jose. B.o.T. (ESB/27228/60).*

7 Jan.—**United Arab Republic.** Motors, pumps, generating sets and accessories for Euphrates/Aleppo water project. Director General du Service des Eaux d'Alep, Syria. B.o.T. (ESB/27200/60).*

17 Jan.—**Australia.** Coloured telephones and components. Director, Stores and Contracts, P.M.G.'s Department, 114 Russell St, Melbourne C.1. B.o.T. (ESB/26933/60).*

No date stated—**India.** Complete 300 MW atomic power station for Maharashtra State. Project Administrator, Apollo Pier Rd, Bombay 1. Tender notice with brief details from Engineering Branch, India Store Department, Government Bldg, Bransford Ave, W.3. Reference S.3700/60/NSC/ENG.2.

CONTRACTS PLACED

ver U.D.C. Supply and erection of "A" and 27 Gp "B" tubular steel lanterns, gear, Abacus Municipal

ford B.C. Erection of 201 Gp "B" 1960-61 street lighting scheme, Municipal Ltd.

I.B. Contracts placed during the past amounting in the aggregate to 00 include: Thorpe Marsh power Aluminium wall cladding, Freeman n Ltd.; structural steelwork for turbine and boiler house for No. 2 unit c Findlay and Co. Ltd. Trawsfynydd power station: 275 kV and multicore and accessories, Pirelli-General Cable Ltd. Blyth "B" power station: Coal plant, Birtley Engineering Ltd. West k power station: Chimney for Nos. 3 oilers, Tileman and Co. Ltd., 3.3 kV ar extension for units Nos. 3 and 4, Electric Co. Ltd. Bankside power

One 136 MVA generator trans-Associated Electrical Industries Ltd. ough power station: Structural steel- ough units 1 and 2, Dawnays Ltd. "C" power station: 132 kV, 3,500 witchgear, A. Reyrolle and Co. Ltd. substation: Four 180 MVA, 275/132 nsformers, Ferranti Ltd. Northfleet station and substations: 132 kV, IVA switchgear, English Electric Co. sleholm substation: 275 kV and 132

kV switchgear, Associated Electrical Industries Ltd. Kingston-Chessington: 132 kV and auxiliary cables, British Insulated Callender's Cables Ltd. Iwer-Weir Weybridge: 132 kV cables at London Airport, British Insulated Callender's Cables Ltd.

London C.C. Supply and installation of cables and miscellaneous works at Southern Outfall Wks. Erith, Johnson and Phillips Ltd., £202,317; L.E.B., £208,434; K.S. Construction Co., £211,765; B.I.C.C., £219,682; James Kilpatrick and Son Ltd., £228,315; A.E.I., £260,654. Lowest tender accepted.

Luton B.C. Electrical installation in Challeney Secondary School extensions, H. C. Jones Ltd., £3,757.

Maldenhead B.C. Stage II street lighting scheme, Erecon Ltd., £2,270. Recommended.

Middlesbrough T.C. Electrical installation in new Thorntree Community Centre, C. Horne and Co. Ltd., £753 12s 6d.

Oadby U.D.C. Supply and erection of 31 Group "B" aluminium columns with 60 W sodium lighting along Leicester and London Rds. Midland Lighting and Bldg Ltd., £1,195.

Scunthorpe B.C. Electrical installations in 54 dwellings, Hobson and Scott Ltd., £1,424. Recommended.

Whickham-on-Tyne U.D.C. Provision of street lighting at Dunston, B. L. Oliver. Recommended.

TRADE NOTES

ges of Address. The registered office Marconi International Marine Commion Co. Ltd. has been changed to i Hse, Chelmsford.

marriott and Hursthouse Ltd. have red their works and offices to larger s at Majestic Works, 700-708 Wood- i Rd, Nottingham. Telephone Not- 62291.

Birmingham office of the Export Guarantees Department has moved mber of Commerce Hse, Harborne

Branch. Negretti and Zambra Ltd. k opened a branch at 38 Dean St, ile upon Tyne.

Telephone Numbers. With effect 1 Oct., the telephone number of Brothers Asbestos Co. Ltd., 14 y Circus, E.C.2, will be changed to Wall 5471.

telephone number of the Middles- branch of British Insulated Cal- Cables Ltd. has been changed to brough 43256.

butors. Winston Electronics Ltd. ointed Hawnt and Co. Ltd., 112- tchett St, Birmingham 6, as their i distributors.

sion. The extension of production d office block at the Bush Fair, . works of Electrical Remote Con- . Ltd. has been completed.

Agreement. An agreement has been signed between Elliott Brothers (London) Ltd. and F.X.R. Inc. of Woodside, New York, under which the two companies will make and sell in their respective territories each others range of microwave instruments. The Elliott territory includes the whole of the British Commonwealth, excluding Canada; that of F.X.R. the United States, its possessions overseas and Canada.

Change of Name. Vokes Ltd. has changed its name to Vokes Group Ltd., and a new subsidiary, Vokes Ltd., has been incorporated to take over the business trading as previously carried on.

Agreement. Londex Ltd., Anerley Works, 207 Anerley Rd, S.E.20, have concluded an agreement for the marketing of electromagnetic valves in the U.K. manufactured by Concordia G.m.b.H., Stuttgart.

Marketing Arrangement. Fothe-gill and Harvey Ltd. and Lantor Ltd. have concluded an arrangement whereby the first-named will sell Lantor products for industrial uses.

Acquisition. Aerialite Ltd. have acquired the manufacturing and distribution rights of the "Casian Trav-ler" tape recorder.

Expansion. John Bages Ltd. have been formed to take over the business hitherto carried on as a partnership at Upoermill, near Oldham, as John Bages and Co. The firm have also moved to new and larger premises at Relay Works, Hollins Rd, Oldham. Telephone Failsworth 3785.

BUSINESS PROSPECTS

Abingdon, Berks. R.D.C. Tender: 22 detached houses on Cumnor housing estate. Surveyor, Council Offices, 60 Bath St.

Alnwick. Hardy Bros. (Alnwick) plan new premises.

Ayr. British Replin, 20 Belvedere Terr, Ayr, plan factory and offices in Heathfield Rd covering 50,000 sq ft.

Basingstoke. Wilkinson Sword, Southfield Rd, W.I., plan possession of six-acre site.—Associated Transistors Ltd. plan factory on 17½-acre site. Mental Health training centre and hostel planned at St. Michael's Rd, South Ham. Hampshire County Architect, Winchester.

Billingham-on-Tees. U.D.C. plans 300 Radburn housing site units. Surveyor.

Bingham R.D.C. Tender: Three houses and 11 bungalows. Architects Wm. Saunders and Ptnrs., 24 Castle Gate, Newark-on-Trent, Notts.

Birmingham. Industrial developments planned: Bissell St for C. E. Rossiter and Co., 227 Moseley Rd; Bissell St for Sturge and Co., 37 Sheepcote St; Bissell St for Birmingham Tempered Spring and Presswork Co., 101 Irving St; Buckingham St for Rodway and Taylor (Birmingham); Howard St, Barr St and Smith St for A. E. Clark and Co. (Tools), 83 Snow Hill.—Tenders: Contract No. 691: 13 one- and two-storey dwellings, Northfield; No. 695: 10 shops and dwellings, Erdington; No. 711: three shops and dwellings, Warstock; No. 718: eight four-storey dwellings, Pool Farm estate; No. 725: 11 two-storey dwellings, Bartley Green. Architect.—Holland W. Hobbs and Ptnrs., 36 Waterloo St, architects for £350,000 Edgbaston High School for Girls, Westbourne Rd.

Bishop Auckland. Matthew C. Robson and Son, 245 Newgate St, architects for Foster and Sons' tinplate factory.

Bournemouth. Orbar Holdings plan shops, offices, showrooms and warehouses at 130/138 Holdenhurst Rd.

Bowden. Manchester Hospital Board, Cheetwood Rd, approve scheme for alterations at Southfield Maternity Hospital and Littlethorpe.

Bromley B.C. Tender: 104 flats Turpington La. Engineer.

Canterbury T.C. Tender: 29 accommodation units Artillery St and Military Rd. Architect.

Cardiff. E. Turner and Sons, Penarth Rd contractors for £76,600 offices for Royal-Globe Insurance Group.

Carlisle. A. F. Sewell, 1 Warwick Rd, architect for Milbourne St office block for Border Engineering Contractors.

Carmarthen. Architects' Co-Partnership, 44 Charlotte St, W.I., architects for £32,000 extensions at Trinity College for Church Training College.

Chelmsford. R. C. Harrison, White Roding, Dunmow, Essex, architect for factory and offices at Beach's Drive for Windley Bros.—Stanley Bragg and Associates, 121 New London Rd, architects for six-storey office block at 77 Springfield Rd for Dr. R. W. Willcocks.—Stanley Keen, 9 The Mews, Roding La, South Ilford, architect for showrooms and office building, 44 Broomfield Rd for Pollards.

Chesham. Fuller, Hall and Foulsham, 212 High Holborn, W.C.1, architects for Met-chain's planned factory.

Chesterfield R.C. Authorities plan three primary schools and extensions to St. Mary's, Cross St.

Chester-le-Street. C. Solomon, 30 St Mary's Pl, Newcastle, architect for shops, offices, etc., at North Burn.

Chichester. Robert Marriott, Midland Wks, Rushden, Northants, contractors for £276,000 extensions to Bishop Otter College for Council of Church Training Colleges.

Croydon. A. Minoprio, 18 Seymour St, W.I., architect for offices, shops, restaurant on site of Trinity School of John Whitgift, North End, for Whitgift Foundation.

Darlington. Fennell and Baddiley, Bridge End Chbs, Chester-le-Street, architects for 20,000 sq ft extensions to Underground Mining Machinery's Aycliffe Estate factory.

Essex. Welfare Committee approves £47,150 estate for Manor Home extensions.

Eston. N. C. Harrison, 246 Normanby Rd, South Bank-on-Tees, surveyor for U.D.C.'s 60 old peoples' flatlets.

Gillingham B.C. Tender: 20 houses as Stage three of Stratford estate. Engineer.

Glasgow. Ingersoll-Rand Co., 165 Queen Victoria St, E.C.4, plan factory at Dalmuir, Clyde-Bank.—Lynn Proofing Co., plan extensions to 356 Amulree St, E.2 works.—H. J. Stuart (Glasgow) plan extensions to 24 Acorn St factory.

Guildford. Roffey, Adamson and Ptnrs., Cumberland Hse, Kensington Court, W.8, architects for Yokes of Guildford's factory extensions, Henley Park.

Harrow. Deacon and Laing, 65 Goldington Rd, Bedford, architects for extensions to Sopers of Harrow's Station Rd store.

Hays. H. O. Luder, 79 Regency St, W.1, architect for E. Alec Colman Group's seven shops with maisonnettes, 15 flats, etc., on site of Essoldo Cinema.

Hemel Hempstead. H. G. Cherry and Ptnrs, 38 Gordon Sq, W.C.1, architects for £242,000 Crabtree La girls' school.

Hucknall U.D.C. Tender: 150 houses and flats Welbeck housing estate. Engineer.

Lackenby. Dorman, Long have £36 million modernisation scheme the greater part of which will be sited at Lackenby.

Leicester. Imperial Typewriter Co., Leicester, plan £100,000 premises, Copdale Rd.

Liverpool. Arndale Property Co., Howard Hse, Bank St, Bradford 1, plan development of Woolton St sites.

London. A. W. Pipe and Son, 8 Queen St, E.C.1, architects for Associated Lead Manufacturers planned new building, West Ferry Rd, E.14.—Anchor Glass Co., Brent Cross Wks, North Circular Rd, plan extensions.—Elliott, Cox and Ptnrs., 172 Buckingham Palace Rd, S.W.1, architects for laboratory at Hendon Way for Johnsons of Hendon Ltd.—Radiation Ltd. plan research laboratories at 255 North Circular Rd, N.W.10.—Medical Research Council, 38 Old Queen St, S.W.1 plans polio research centre, National Institute for Medical Research, The Ridgeway, N.W.7.—Victor Heal and Ptnrs., 14 Gray's Inn Sq, W.C.1, architects for six-storey offices Warwick La, E.C.4, at junction with Warwick Sq.—Colbeck and Ptnrs., Palmerston Hse, Bishopsgate, E.C.2, architects for rebuilding of 27-38 St. Clements La, E.C.—Hammeron Property and Investment Trust plans rebuilding of parts of Coleman St and Basinghall St, E.C.2.—L. R. Kinsler and Ptnrs., 28 Berkeley Sq, W.1, quantity surveyors for Caxton St, S.W.1 office buildings.—Plans submitted to St. Pancras B.C. for shops, showrooms, offices at Windmill St, Tottenham Court Rd and Percy St, shops and offices at Camden High St, shops and showrooms at Euston Rd, etc.—12-storey building planned at 252-280 Euston Rd.—Shaw and Lloyd, 74 Gt Russell St, W.C.1, architects for rebuilding of French Railway's Piccadilly offices.—W. J. Bonfield, 46 Queen Anne St, W.1, architects for nine-storey Lower Sloane St, S.W.1 building.

Macclesfield. Manchester Hospital Board, Cheetwood Rd, Manchester plan 42-bed maternity unit, West Park.

Maldstone. Factory Holdings Group, 36 Wigmore St, W.1, plan Park Wood Trading Estate factory.

Manchester T.C. Tender: Contract 301/351 Councillor La, Cheadle dwellings and Contract 332/341, 144 dwellings Wythen-

shawe. Director of Housing.—Tender: Traffic and baggage wings, customs and restaurant wing and flights wings, piers, etc, at new terminal building, Manchester Airport. Architect.

Middlesbrough. J. G. D. Poulson, 54 Albert Rd, architect for Jordinson and Co.'s Longlands Rd printing works.—P. A. Mudd and Lionweld plan extension scheme for 204 ft by 40 ft building for plant, workshop, etc.—St. Stevenson Jones, Harley Buildings, Old Hall St, Liverpool, architect for Kirkham Row, Beechwood R.C. Church and Hall.—T.C. plans £54,200 street lighting programme. Engineer authorised to place £6,145 of orders for supply of 440 lighting columns.

Newcastle T.C. 180 flats in two 15-storey blocks planned for Longbenton housing site. City Architect.

Nottingham T.C. Tender: 150 houses, 54 flats and 10 bungalows Bestwood Pk estate. Estate Surveyor and Valuer, W. E. S. Martin, The Guildhall.

Northumberland C.C. Tender: three practical rooms and classroom at Walbottle Campus site. County Architect.

N Ridding C.C. Johns, Slater and Haward, 32 Foundation St, Ipswich, architects for Stage 2 of Thornaby Grange County School.

Oxford. Mansfield College plans three-storey students' residential block.—University Chest plans eight-storey block of teaching and research laboratories for biochemistry department at South Parks Rd. Cost: £400,000.—New buildings to cost £68,000 planned at Department of Catering and Hotel Management, Oxford College of Technology.

Oxfordshire. £836,390 development project planned at Bordcourt Hospital, Peppard. Regional Hospital Board, Banbury Rd approves.

Paisley. S. Lothian Barclay and Jarvis, 19 Woodside Pl, Glasgow C.3, architects for whisky plant and offices for Chivas Bros.

Petworth R.D.C. Tender: Eight flats, Kirkford and 12 flats Luffs Meadow, North-chapel. Clerk.

Plymouth. Corporation plans three new clinics and community mental health centre at Seven Trees site at £64,830.

Portsmouth. Land and Commercial Holdings plan factory and offices at Fitzherbert Rd, Farlington.—Collis and Co., Cosham, plan warehouse and offices, Portsmouth Rd.

Prudhoe. Ambulance depot at West Wylam planned by C.C. County Architect.

Reading. Greenslade and Co. (Reading), Kings Bridge, plan Commercial Rd factory.—Southern Gas Board, 4 Gasworks Rd, plan industrial development on King's Meadow land.

Rugby. Willow Engineering (Rugby), Willow La, plan rebuilding of factory.—English Electric plan extension to Willans Wks, Newbold Rd, research laboratory.

Stamford, Lincs. MacAuslan, Abbott and Ptnrs, 3 Smithfield St, Liverpool 3, recommended consulting engineers for electrical services and a.c./d.c. changeover at Raucby Hospital.

Staines. Dyneley, Luker and Moore, 1 Lincoln's Inn Fields, W.C.2, architects for Petters Ltd. research building at The Causeway.

Stockton-on-Tees. 36 bungalows Rochester Rd planned. Borough Architect (T. C. Hartley), 28 The Square, Stockton.

Sunderland. Students' union and hostel block planned South Johnson St. Borough architect.—Newcastle Hospital Board, Benfield Rd, Newcastle, plan £7,000 additions to Royal Infirmary pathological dept.

Swindon. Holland & Hannen and Cubitts (Gt. Britain), 1 Queen Anne's Gate, S.W.1, contractors for The Pressed Steel Company's £31 million production plant at Stratton St. Mary.

Tottenham B.C. Tender: 16 Braemar Rd dwellings. Engineer.

Waltham-on-Thames. S.W. Metropolitan Hospital Board, Eastbourne Terr, W.2, plan convalescent home, Queen's Rd, at £100,000.

Business Prospects—Continued

Wallasey B.C. plans health clinic at Twickenham Drive. Architect.

Wallend-on-Tyne. S. W. Milburn and Ptnrs., 9 Esplanade, Sunderland, architects for George Angus and Co.'s planned Coast Rd factory extensions.

West Bromwich. Copper and Alloys plan extensions at Greets Green Rd.—Robinson Bros. plan warehouse and three process buildings at Phoenix St.—Charles (Wednesbury) Ltd., plan offices, etc., at Holloway Bank.

West Dean R.D.C. Tender: 26,000 super ft, Tufton Ave, Coleford, industrial bldg and offices. Engineer and Surveyor, Coleford.

West Riding C.C. £19,375 Park La Primary School extensions and new primary schools at Kirk Sandall and Bentley plus new secondary school at Bentley proposed.

Wiltshire. Tidworth Down County Secondary School as £109,452 addition to M.E.'s 1961-2 programme.

Wirksworth. John Bowmer and Son plan new factory at Water La.

Worcester C.C. Tender: 171 Warden estate dwellings. City Engineer, 22 Bridge St.—Tender: Bromsgrove Ruberg infants' school and clinic. Architect, 14 Castle St.

Workington T.C. 200 houses planned.

York T.C. Tender: 30 Long Close La flats. Architect.

Gazette Announcements

COMPANIES ACTS

West Lancashire Electronic Products Ltd. Creditors to send details to liquidator: C. Mead, 55 Houghton St, Southport, by 8 Nov.

Domestic Electric (Kent) Ltd. Mr C. Goodwin, Trevone, Ash, Sevenoaks, Kent, appointed liquidator at extraordinary general meeting on 1 Oct. for the purpose of winding-up.

G. Norton and Co. Ltd. Mr R. A. Haigh, Court Chmbrs, Friar La, Leicester, appointed liquidator at extraordinary general meeting on 10 Oct. for the purpose of voluntarily winding-up.

Ferris Domestic Appliances Ltd. Petition for winding-up to be heard before the High Court of Justice on 31 Oct. Persons intending to appear to notify Kimbers, 34 Nicholas La, E.C.4, by 29 Oct.

Renteale Ltd. Mr R. A. Hawken, Bank Chmbrs, 1 John St, W.C.1, appointed liquidator at extraordinary general meeting on 11 Oct. for the purpose of voluntarily winding-up.

Mau-bit Distributors Ltd. Mr R. A. Hawken, Bank Chmbrs, 1 John St, W.C.1, appointed liquidator at extraordinary general meeting on 11 Oct. for the purpose of voluntarily winding-up.

L. P. Tibbitts Ltd. and L. P. Tibbitts (Radio and Television) Ltd. Mr R. A. Hawken, Bank Chmbrs, 1 John St, W.C.1, appointed liquidator at extraordinary general meeting on 11 Oct. for the purpose of voluntarily winding-up.

Astoria Electrics Ltd. Meeting of creditors to be held at 29a New Cavendish St, W.1, on 14 Nov., at 11 a.m.

Derwent Exports (London) Ltd. Last day for receiving proofs for intended dividend: 31 Oct., to be sent to liquidator: H. W. Pitt, 100 Park St, W.1.

D.E.S. (Sewing Machines) Ltd. Last day for receiving proofs for intended dividend: 29 Oct., to be sent to liquidator: F. M. Collins, Inveresk Hse, 346 Strand, W.C.2.

Gayer and Cresswell (Manchester) Ltd. Mr H. S. Stafford, 61 Brown St, Manchester 2, appointed liquidator at extraordinary general meeting on 13 Oct.

Progressive Eng. Co. (1929) Ltd. Mr F. A. Blake, 19 Fenchurch St, E.C.3, appointed liquidator at extraordinary general meeting on 14 Oct.

Barbados Electric Supply Corp. Ltd. Mr J. R. M. Valentine, 3 London Wall Bldgs, E.C.2, appointed liquidator at extraordinary general meeting on 14 Oct. Creditors to send details to liquidator by 25 Nov. Formal notice: all creditors to be paid in full.

Garjohn Electrics Ltd. Mr J. F. Johnsen, 8 Bellevue Rd, Southampton, appointed liquidator as from 29 Sept.

Tungsten Mfg. Co. Ltd. General meeting of members and creditors to be held at 19 Eastcheap, E.C.3, on 28 Oct., at 11.30 a.m. and 12 noon, respectively, for the purpose of receiving an account of the winding-up.

BANKRUPTCY ACTS

First Meeting and Public Examinations

Slough. R. G. Daniels, electrical retailer, carrying on business as Hayden Television at 51-53 Oxford Rd, Windsor. First meeting: 11.30 a.m., 28 Oct., at 58-61 York Terr, Regent's Pk, N.W.1; and public examination: 11.30 a.m., 14 Dec., at Law Courts, Windsor Rd, Slough.

Blackpool. G. T. Smethurst, electrical dealer, formerly carrying on business in partnership as S. Gee and Co., 178 Watson Rd, Blackpool. Public examination: 10.30 a.m., 9 Nov., at Court Hse, South King St, Blackpool.

Cardiff. R. P. Harris, electrician, of 68 Paget St, Grangetown. Public examination: 10.30 a.m., 2 Dec., at County Court, County Court Bldgs, Westgate St, Cardiff.

Blackwood, Tredegar. P. Talbot, radio, television and electrical goods retailer, carrying on business at 100 Bailey St, Brynmawr, Brecon, and 19 Somerset St, Abertillery. Public examination: 11.30 a.m., 6 Dec., at County Court, Blackwood Rd, Blackwood, Mon.

Appointment of Trustees

Barnstaple. G. H. Cornwell, electrical retailer, formerly carrying on business as "Tele-Speed," at 21 Rockmount, Pitt La, Bideford. Mr J. E. Ellis, 50 The Terrace, Torquay, appointed trustees as from 30 Sept.

Blackwood, Tredegar. P. Talbot, radio, television and electrical goods retailer, carrying on business at 100 Bailey St, Brynmawr, Brecon, and 19 Somerset St, Abertillery. Mr G. H. Down, 106 Walter Rd, Swansea, appointed trustee as from 12 Oct.

Dividend

Bradford. K. M. Ashworth and D. Revell, electrical contractors, carrying on business as Ashworth and Revell at 265 Bradford Rd, Frizinghall, and 120 Otley Rd, Shipley. Separate estate of D. Revell dividend per £: 2s 6d, payable at Official Receiver's Office, 20 North Parade, Bradford 1, on 27 Oct.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Andard-Mount Co. Ltd., 82 Portland Pl, W.1. Manufacturers of and dealers in general electrical equipment, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: David W. Grey and David Wade.

Belclere Co. Ltd. To acquire the business, assets and undertaking of that department of Savory and Moore Ltd. which is concerned with the distribution of acoustic appliances, electrical transformers, etc. Nom. cap.: £5,000. Dirs.: not named. Subs.: George Conrad and John R. Hamer-Harries, 11 Old Jewry, E.C.2.

Brewer and Phillips Ltd., 66 Regent St, Plymouth, Devon. Electrical engineers and contractors, manufacturers of and dealers in radio and television apparatus, etc. Nom. cap.: £5,000. Dirs.: John F. Hurford, Mildred A. Edmunds and Wm. L. Long.

Charles R. Barker Ltd., 18-19 Southgate St, Bishop Auckland. To take over business of an electrical and mechanical engineer carried on at Bishop Auckland by Charles R. Barker, etc. Nom. cap.: £1,000. Permanent dirs.: Charles R. Barker and Daisy M. Barker.

Delmos Ltd., 8 Corwell La, Hillingdon, Middx. Electronic and automation engineers, etc. Nom. cap.: £100. Dir.: John C. Latham.

Edison Gill Co. Ltd., Bayton Rd, Exhall, Warwicks. To carry on business of electrical equipment specialists, etc. Nom. cap.: £100. Dirs.: Harry L. Gill and Lilian E. Gill.

Electro Scientific Ltd., Alexander St, Chesham, Bucks. Manufacturers of and dealers in electronic tubes, valves, etc. Nom. cap.: £500. Dirs.: Leslie F. Mitchell and Mrs Helen E. Mitchell.

General Steel Wares Ltd. British address: Regina Hse, 259 Marylebone Rd, N.W.1. Registered in Canada in October, 1927, to carry on business of manufacturers of and dealers in metals, brass finishers, etc. Capital: 69,062 5% cum. preferred shares of £100, and 1,000,000 common shares without nominal or par value. Name of person authorised to accept service: Ronald T. Williams.

J. D. Henderson Ltd., 35 New Broad St, E.C.2. Electrical engineers, etc. Nom. cap.: £1,000. Dirs.: Jack D. Henderson and Jack Walton.

Hounslow Heath Electrical Ltd. Nom. cap.: £100. Buyers and sellers of, dealers in and manufacturers of electrical and elec-

tronic apparatus, etc. Dirs.: Mrs Rosemary S. Bailey, 12 Stratton Rd, Sunbury-on-Thames, and James Bailey, 381 Staines Rd, Hounslow, Middx.

Houston and Bramley Ltd., Avenue Wks, Starbeck, Harrogate. Manufacturers of and dealers in electrical equipment, etc. Nom. cap.: £100. Dirs.: Donald B. Houston and Joseph R. Bramley.

Inflex Ltd., 3 Gray's Inn Sq, W.C.1. Mechanical, electrical, precision and general engineers, etc. Nom. cap.: £100. Dirs.: Tibor Funk, Maurice Pryce and Louis R. Vaughan.

Marshall's (Electrical Engineers) Ltd., 266-70 Bethnal Green Rd, E.2. Nom. cap.: £100. Dirs.: Moss Shalet, Mrs Esther Shalet, Mark Westbrook and Mrs Shirley E. Westbrook.

Norel Electrical Appliances Ltd., 26 High St, S.W.19. Nom. cap.: £1,000. Dirs.: Michael S. Thompson and Ignacy J. Koziel.

R. and L. Paul (Kenton) Ltd., 42 Mount Pleasant, Wembley. Electrical engineers and contractors, etc. Nom. cap.: £100. Dirs.: Paul F. F. Eycken, Olive L. Eycken and Alan Hill.

Rank Cintel Ltd. Manufacturers of and dealers in electronic devices, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Alan Peterson and David Preston, 11 Waterloo Pl, S.W.1.

Street Lighting Ltd., 100 North Sherwood St, Nottingham. Manufacturers of and dealers in street lighting equipment, etc. Nom. cap.: £100. Dirs.: Ralph Lowe and Geoffrey F. G. King.

Telekill Ltd., 43 Upper Berkeley St, W.1. Manufacturers of and dealers in electrical goods of all kinds, etc. Nom. cap.: £100. Dirs.: Cyril G. Schilling and Delia M. Banks.

W. Thatcher (Electrical Contractors) Ltd., 144-6 Desborough Rd, High Wycombe, Bucks. Nom. cap.: £1,000. Dirs.: William H. Thatcher and Marjorie J. Thatcher.

Warden Electrics Ltd., 130 Monument Rd, Ladywood, Birmingham 16. To take over the business carried on by Alfred L. Warden at Ladywood, Birmingham, etc. Nom. cap.: £100. Dirs.: Alfred L. Warden and Sylvia Newman.

John B. Woodward (Electricians) Ltd., 176 Cherry Orchard Rd, Handsworth Wood, Birmingham 20. Nom. cap.: £5,000. Dirs.: John B. Woodward and Dennis M. Davy.

MEETINGS TO NOTE

THURSDAY, 27 OCT.

I.E.E. "The Principles and Operation of Large Radio Telescopes," A. Hewish. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S. Midlands). "Some Aspects of Engineering in Polar Regions," D. L. Pratt. Midland Institute, Birmingham. 6.30 p.m.

I.E.E. (Southern Graduates and Students). "Gramophone Pickups for Stereo and Mono Reproducers," D. J. Edwards. Technical College, Brighton. 6.30 p.m.

I.E.E. (N. Scotland). Sub-centre chairman's address, L. F. Dorward. Electrical Engineering Department, Queens College, Dundee. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Analogue Computers," W. E. Willison. Lecture Theatre, Administrative Building, The Associated Ethyl Co. Ltd., O.I. Sites Rd, Ellesmere Port, Wirral. 7 p.m.

A.S.E.E. (E. and W. Kent). Dinner. Star Hotel, Maidstone.

A.S.E.E. (S. London). "Industrial Applications of Isotopes," T. B. Rowly. Greyhound Hotel, High St. Croydon. 8 p.m.

A.S.E.E. (N. Ireland). "Protection Equipment for Industrial Plants," Dr W. L. Stern. Central Hall, Rosemary St, Belfast.

A.S.E.E. (Oxford and Districts). "Interference Suppression in Industrial and Research Establishments," A. C. F. Leadbitter. Reactor School, Harwell. 5.45 p.m.

FRIDAY, 28 OCT.

I.E.E. (N. Scotland). Sub-centre chairman's address, L. F. Dorward. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scottish). "Instrumentation of a Steel Strip Mill," H. Gill. Building Centre, Sauchiehall St, Glasgow. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Cheltenham). "The Atomic Clock," L. Essex. Belle Vue Hotel. 7.30 p.m.

A.S.E.E. (Coventry and District). "Technical Education for the Electrical Engineer," M. M. Robins. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy Lane. 8 p.m.

SATURDAY, 29 OCT.

A.S.E.E. (Bradford and District). Dinner, Gt. Northern Hotel, Bridge St. 7.30 p.m.

MONDAY, 31 OCT.

I.E.E. (E. Anglia). "Modern Coal-fired Power Stations," A. E. Hawkins. Assembly Hse, Norwich. 7.30 p.m.

I.E.E. (Mersey and N. Wales). "The Application of Irradiation in Industry," M. C. Crowley-Milling. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). "New Amplifying Techniques," Prof C. W. Ostley. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (Malvern Group). A.G.M. and "Applications of Microwaves," Prof A. L. Cullen. Winter Gdns, Gt. Malvern. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Applied Mechanics and Lubrication Groups). Discussion: "Roller Bearing Problems—Is There a Need for Fundamental Research?" Birdcage Walk, S.W.1. 6 p.m.

I.E.S. (Leeds). "Ship Lighting—Perils and Prospects for the Lighting Engineer," J. T. Grundy and G. H. Vaughan. Institute of Technology, Bradford. 7 p.m.

TUESDAY, 1 NOV.

I.E.E. (Measurement and Control Section). "Transistor Instrumentation in Rockets," G. G. Hagh. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). "The Impulse Strength of Impregnated-Paper Dielectrics as Used in High-Voltage Cables," B. Salvage and J. A. M. Gibbons. Workington College of Further Education. 7 p.m.

I.E.E. (N.W. Utilisation Group). "Factories Act—Electricity Regulations," S. J. Emerson. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Midlands). "A New Form of Crane-Hoist Control Using a 3:1 Pole Changing Induction Motor," O. I. Butler and V. Ahmad. Leeds and County Conservative Club, South Parade, Leeds. 6.30 p.m.

I.E.E. (S.E. Scotland). "Engineering and Civilisation," Sir Hugh Beaver. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (Rugby Graduates and Students). "The Mercury Arc Converter and its Applications," P. Richardson. College of Engineering Technology. 6.30 p.m.

INSTITUTION OF PLANT ENGINEERS. "Municipal Engineering Services," A. F. Holt. At R.S.A., John Adam St, Adelphi, Strand, W.C.2. 7 p.m.

A.S.E.E. (S.E. London). "Electric Floor-warming," D. W. Ackery. Eltham Green School, Queenscroft Rd, S.E.9. 7.45 p.m.

A.S.E.E. (W. London). "Silicone Rectifiers," D. R. Coleman. Windsor Castle Hotel, 134 King St, W.6. 7.45 p.m.

A.S.E.E. (Reading and Districts). "High-frequency Heating and Plastic Welding," W. D. Wilkinson. Marquis of Lorne, Friar St. 7.30 p.m.

WEDNESDAY, 2 NOV.

I.E.E. (Electronics and Communications Section). "The Ionosphere—A Review of Recent Progress," Professor W. J. G. Beynon. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Southern). "The Electrical Simulation of Heat Flow in the Analysis of Cooling Systems for Electrical Equipment," B. M. Weedy. The University, Southampton. 7 p.m.

I.E.E. (Tees-side). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Cleveland Scientific and Technical Institution, Middlesbrough. 6.30 p.m.

A.S.E.E. (N. London). "Applications of Ball and Roller Bearings," A. Hill. Wood Green Civic Centre, Town Hall, N.22. 8 p.m.

A.S.E.E. (Manchester). "Recent Developments and Applications Involving the Use of Semiconductor," Engineers' Club, Albert Sq. 7.15 p.m.

A.S.E.E. (Preston). "Electric Motors in Agriculture," J. B. Abbott. R.A.F.A. Club, East View. 7.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Radar Group). Discussion: "Radar—Pulse or C.W.?" London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

I.E.S. (Edinburgh). "Lighting for Photography," R. W. Urwin. Y.M.C.A. Social Room, 14 South St, Andrew St. 6.15 p.m.

I.E.S. (Newcastle). "Ship Lighting," J. T. Grundy. Room B7, The Percy Bldg, King's College, Queen Victoria Rd. 6.15 p.m.

I.E.S. (Swansea). "Industrial Lighting," Demonstration Theatre, S.W.E.B., Kingsway, Swansea. 6 p.m.

THURSDAY, 3 NOV.

I.E.E. (Joint meeting with Civils and Mechanicals). "The Training of Overseas Graduate Engineers, with Particular Reference to the F.B.I. Scholarships Scheme," W. Abbott. Savoy Pl, W.C.2. 5.30 p.m.

A.S.E.E. (Brighton, Hove). "Electrification of the Railways," T. R. Hynes. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. "Features in the Design and Construction of Heavy Machine Tools," J. H. Rivers. Hoffmann's Social Hall. 7.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Midlands). "Electronic Sector Scanning," Prof D. G. Tucker. Winter Gdns, Malvern. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N. Western). "Video-tape Recording," P. Denby. Reynolds Hall, College of Technology, Manchester 1. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (E. Midlands). "Instrumentation in Biophysics," F. A. Glover. College of Further Education, Greenclose La, Loughborough. 7.15 p.m.

I.E.S. (Birmingham). Ladies' Night. Botanical Gdns, Edgbaston. 7.30 p.m.

I.E.S. (Glasgow). "Lighting for Ships," J. T. Grundy. Joint meeting with Institution of Engineers and Shipbuilders in Scotland. Weir Hall, 39 Elmbank Cres. 6.30 p.m.

I.E.S. (Nottingham). "Horticultural Lighting," A. W. Gray. Electricity Centre, Carrington St. 6 p.m.

FRIDAY, 4 NOV.

I.E.E. (Medical Electronics Group). Discussion: "Electro-Convulsive Therapy," Savoy Pl, W.C.2. 6 p.m.

I.E.E. (N.E. Graduates and Students). "Aspects of Large Thermal Power Station Construction, Operation and Management," R. Lott. Grey Hall, King's College, Newcastle. 6.30 p.m.

A.S.E.E. (Liverpool). "Industrial Lighting," J. D. Ducker. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "The Development of Plastic Insulated Mains Cables, Jointing and Terminating," D. H. Booth. Royal Hotel, Crewe. 7.30 p.m.

A.S.E.E. (Wolverhampton and District). Dinner/dance at Star and Garter Hotel, Victoria St. 7.30 p.m.

N.E. ELECTRICAL CLUB ANNUAL DINNER, County Hotel, Newcastle upon Tyne.

INSTITUTION OF PLANT ENGINEERS (Kent). Branch Annual Dinner and Dance at Central Hotel, Gillingham.

A.P.L.E. (S. Western). Induction of chairman, followed by "Public Lighting Plan for Weston-super-Mare," J. R. Freer-Hewish, and "The Electricity Board's Part in Public Lighting," H. G. B. Dickinson. Town Hall, Weston-super-Mare. 2.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "Automation in the Post Office," W. S. Rodda. Adm n. Bldg, Esso Refinery. 5.30 p.m.

SATURDAY, 5 NOV.

I.E.E. MECHANICALS AND CIVILS (London Graduates and Students). Joint dance. Carlton Rooms, Maids Vale, W.9. 7 p.m.

MONDAY, 7 NOV.

I.E.E. Discussion: "The Impact of Television on Society," Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). "Water-Turbine Driven Induction Generators," C. L. C. Allan. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands). "A Survey of Street Lighting and Its Future," W. R. Stevens and H. M. Ferguson. James Watt Memorial Institute, Birmingham. 6.30 p.m.

I.E.E. (Scottish Electronics and Measurement Group). "Advances in Semiconductor Devices and Circuits," J. Evans and T. H. Walker. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

I.E.E. (Maidstone). "Subscriber Trunk Dialing," H. E. Francis. Maidstone Technical College. 7 p.m.

I.E.E. (Mersey and N. Wales). Annual dinner. Adelphi Hotel, Liverpool. 7 p.m.

N.E. ELECTRICAL CLUB. "Flameproof at Home and Abroad," M. J. Deering. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (N. Eastern). "Economic Distribution of Steam," J. A. Robbins. Newcastle. 6 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Comparatron. 802,001. Class 9. Electronic test equipment for measuring or comparing two electrical quantities, etc. Mec-Test Ltd, The Lye, St. John's, Woking, Surrey.

Double Eddy. In design, 788,968. Class 11. Installations of the centrifugally operated type for the recovery of industrial dusts, etc. Ambuco Ltd., 2-5 Bond St, W.1.

Erma. 797,580. Class 7. Machines for crimping, etc. Erma Ltd., Mount Pleasant, Alpertown, Wembley, Middx.

Hummel. B796,777. Class 9. Electric arc and resistance welding apparatus, etc. Elektro-Bau A.G., Krauss Strasse 7, Linz, Donau, Austria.

Atropole. 801,431. Class 7. Washing machines. Laden S.A., 3 rue Monceau, Paris 8e, France.

Mill mike in design, 795,411 '2. Class 9. Apparatus, etc. Edgerton, Germeshausen and Co. Inc., 160 Brookline Ave, Boston, Massachusetts, U.S.A.

Orthonull. 799,566. Class 9. Resistance bridges. General Radio Co., West Concord, Massachusetts, U.S.A.

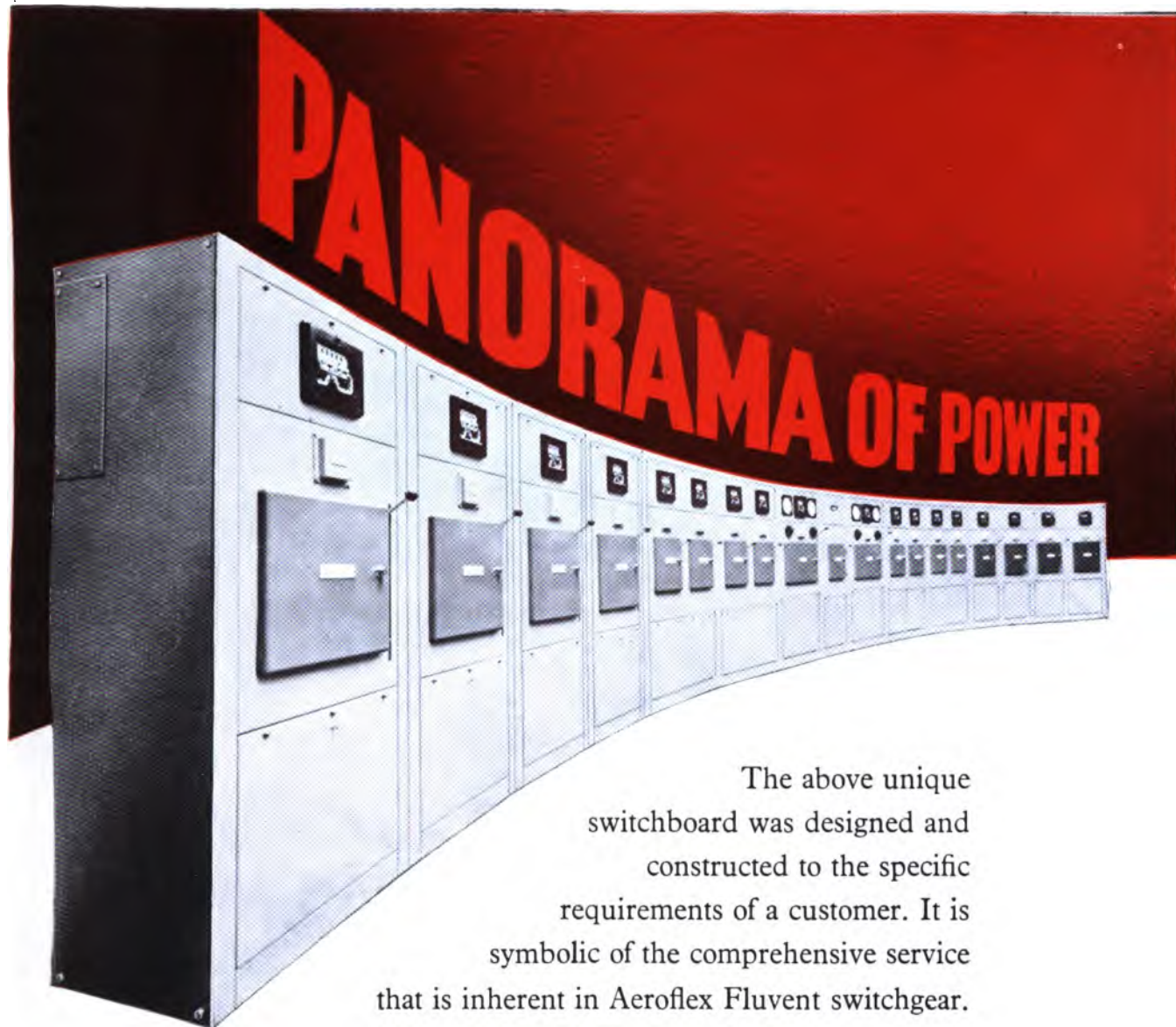
Silver Queen. 804,305. Class 11. Heating and lighting apparatus, etc. Aladdin Industries Ltd., Aladdin Bldg, Western Ave, Greenford, Middx.

Sturton. B802,359. Class 10. Electro-medical acoustic apparatus, etc. Highgate Optical Mfrs. Ltd., 44 Hatton Gdn, E.C.1.

Technelec. 806,893. Class 17. Electrical insulation varnishes, etc. Technical Dielectrics Ltd., Newhive Wks, Pennington St, Walslow, Bury, Lancs.

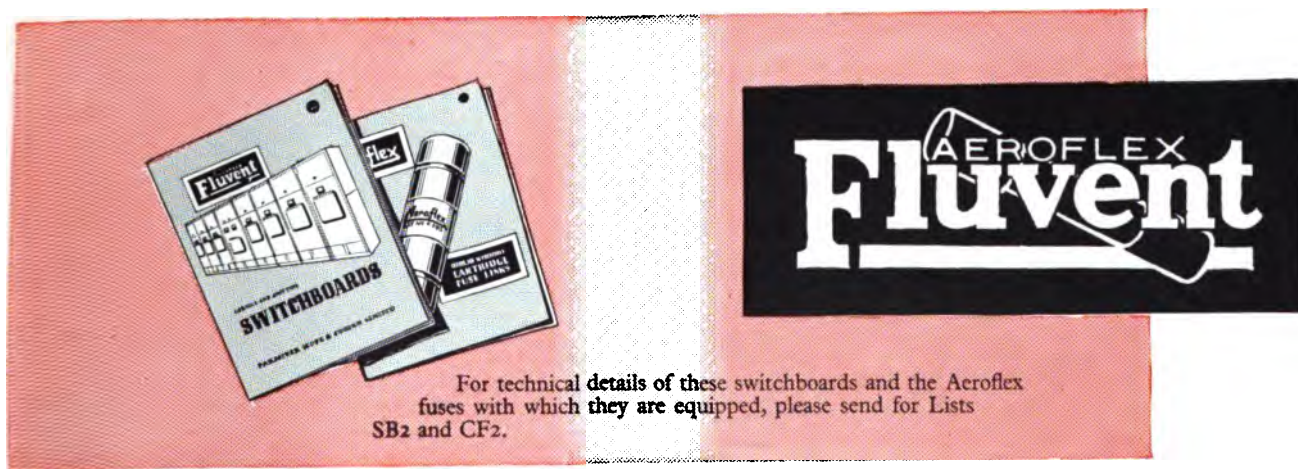
Vacmobile. 804,862. Class 9. Suction cleaning apparatus for industrial use. Vacmobile Mfg. Co. Ltd., Albion Wks, Old Oak, Common La, N.W.10.

Whirlpool. 801,723. Class 9. Vacuum cleaners, floor polishing machines, etc. Whirlpool Corp., 300 Broad St, St. Joseph, Michigan, U.S.A.



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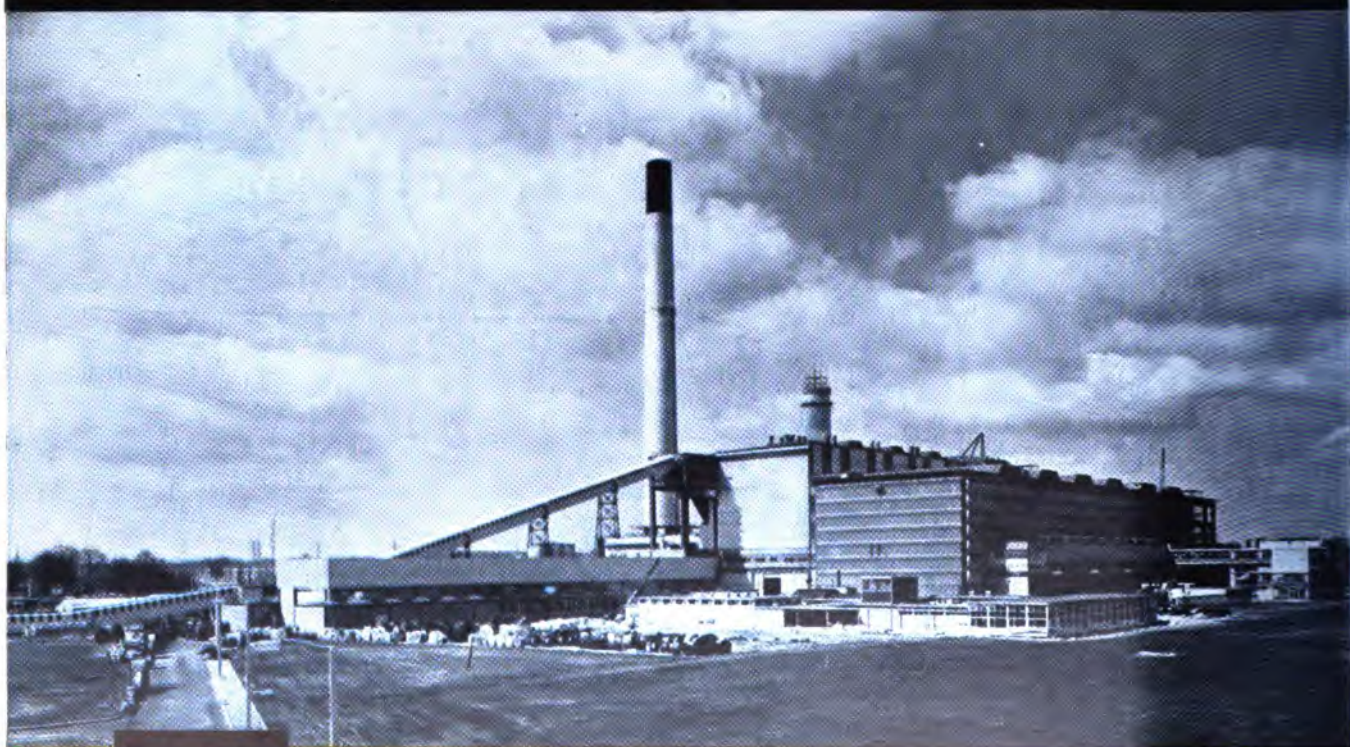
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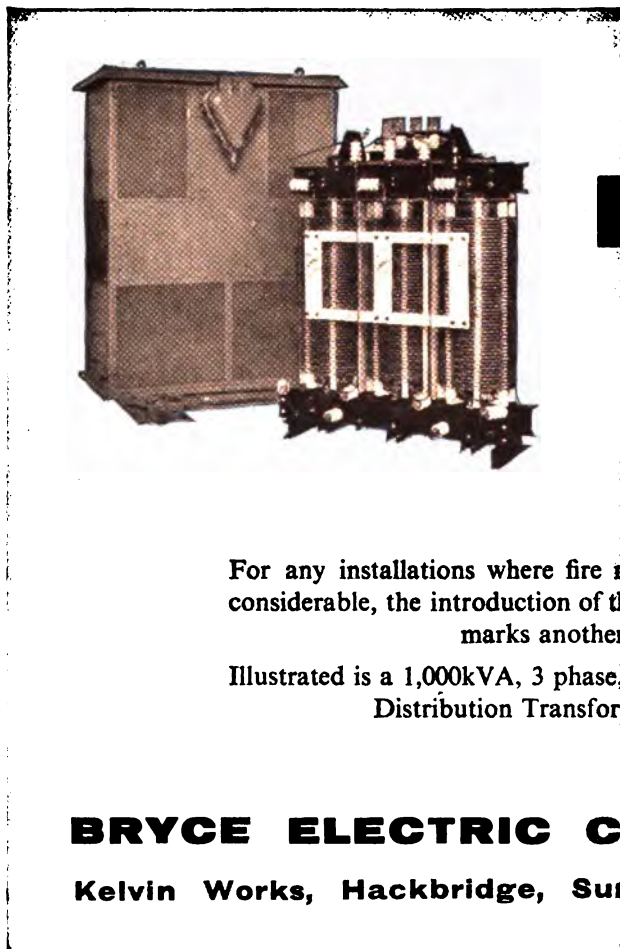
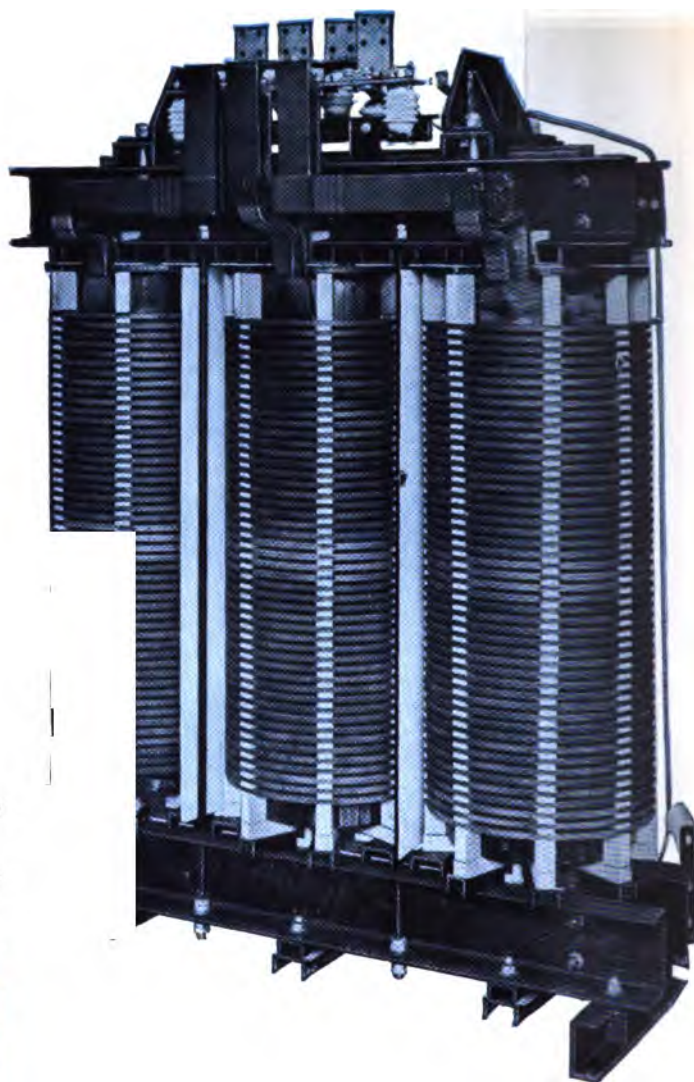
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Dans ce numéro

Analyseur de réseau de la 'CEGB' ... 667
Deux grands analyseurs analogues de réseau sont installés au Service Central de la "Central Electricity Generating Board," à Londres. L'un est un analyseur de courant continu, employé pour études rapides d'ordre préliminaire; l'autre, est un dispositif de courant alternatif donnant un degré de précision très élevé pour l'étude des systèmes d'opération et de stabilité. L'analyseur à courant continu est opéré à l'aide d'une alimentation de 1,000 cycles et comprend 32 unités génératrices, 64 unités d'impédance de charge, 162 unités d'impédance de ligne, 30 unités autotransformatrices et 24 unités de transformateurs de couplage.

Le Centrale Nucléaire de Bradwell ... 677
La charge et la décharge d'éléments combustibles à la Centrale Nucléaire de Bradwell seront assurées par une seule machine d'une capacité de 400 tonnes, onérée par commande à distance. La livraison des combustibles à la Centrale est maintenant en cours, et ceux-ci seront chargés dans les réacteurs nucléaires à partir du mois de mars, 1961.

L'Industrie et le courant continu ... 679
Il existe une demande considérable de la part de l'Industrie pour le courant continu, et cette demande doit être satisfaite par l'emploi d'un appareil de redresseur, groupes Ward-Leonard et dispositifs semblables. Dans certaines industries, notamment les procédés électrochimiques, les demandes pour courant continu sont nombreuses et représentent la majeure partie des besoins de force motrice pour l'industrie; toutefois, dans le cas d'autres industries, tels que les laminaires, trains à bandes, etc., les courants continu et alternatif ont tous deux leur place dans les commandes électriques. De telles demandes, qu'elles soient par l'entremise de groupes redresseurs ou de moteurs-générateurs, ont un effet tout aussi bien sur le voltage que sur la forme d'onde à la source du courant.

In dieser Nummer

C.E.G.B. Netzüberwachung, I ... 667
Im Hauptverwaltungsgebäude der Central Electricity Generating Board in London sind zwei grosse Analog-rechengeräte zur Netzuntersuchung und -überwachung aufgestellt worden. Das eine davon ist ein Gleichstromgerät und dient der schnellen Durchführung von vorläufigen Untersuchungen. Das andere ist ein Wechselstromgerät, das bei Betriebs- und Stabilitätsuntersuchungen, Messwerte von höchster Genauigkeit liefert. Letzteres wird mit Wechselstrom von 1 000 Hz gespeist und umfasst 32 Generatormessplätze, 64 Belastungs-impedanz-Messplätze, 162 Leitungsimpedanz-Messplätze sowie 30 Autotransformatoren- und 24 Kopplungs-transformatoren-Messplätze.

Kernkraftwerk Bradwell ... 677
Das Ein- und Austragen der Brennstoffelemente im Kernkraftwerk Bradwell wird mittels einer einzigen, 400 Tonnen wiegenden, ferngesteuerten Maschine bewerkstelligt. Die Belieferung dieses Kraftwerks mit Brennstoff hat bereits begonnen und man rechnet damit, dass das Eintragen des Brennstoffes in die Reaktoren ab März 1961 erfolgen wird.

Industrielle Gleichstromversorgung ... 679
Der industrielle Bedarf an Gleichstrom ist ein beträchtlicher und er erfordert die Verwendung von Gleichrichteranlagen, Leonardsätzen und ähnlichen Einrichtungen im grösseren Massstabe. In manchen Industriezweigen, namentlich im elektrochemischen, stellt der Gleichstrombedarf den grössten Teil des Gesamtstrombedarfs dar; in anderen, z.B. in Walzwerken, Bandstahlstrassen u. dgl. wird sowohl Gleichstrom wie auch Wechselstrom zu Antriebszwecken verbraucht. Eine hohe Inanspruchnahme durch Gleichrichter oder Motorgeneratorsätze gelieferten Gleichstroms wirkt sowohl auf die Spannung wie auf die Wellenform des Eingangsstroms zurück.

ELECTRICAL
TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

CEGB Network Analyser Installations—Part 1 ... 667
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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 3 NOVEMBER, 1960

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News Editor:

T. W. WRIGHT

Comment

SERVICING CONTRACTS

GEC'S Nicholas Stacey is establishing a reputation for seldom speaking on electrical trading without saying something thoroughly thought-provoking. His latest subject has been the problem of servicing. With the electrical industry committed to mass production, with mass distribution and consumption and mass financing being energetically tackled, he sees mass servicing as the big remaining problem on the horizon. In this, of course, he echoes EDA chairman Mr T. E. Daniel, who, at this year's BEPC, was pointing out the growing liking of housewives for service contracts covering inspection and adjustment for an annual fee, and at the same time warning of the annoyance factor where possession of half a dozen major electrical appliances can mean half a dozen different service men calling a year. Mr Stacey thinks there is opportunity here for someone who is willing to come in with a standard-charges, standard-service schemes. Mr Daniel considers that the electricity boards are exceptionally well placed to offer such a service, with manufacturers still dealing with any repairs other than the simplest. What about practice elsewhere? Pilot schemes are now in operation in the USA, covering attention to all appliances of a large manufacturer, at a fixed charge. Their development will need to be watched. In this country, the increased activity of the Electrical Contractors' Association in retailing, together with the apparently greater flexibility of working of private retailers, may bring a challenge to the claim of the area boards for first choice in front line servicing. What is sure is that when such close students of the electrical scene discern a need so clearly as to push it in public, there is opportunity for someone willing and able to tackle undoubted difficulties and complexities in return for substantial rewards.

HYDRO IN ROUGH WATER

A double-pronged attack was opened last week on the plans of the North of Scotland Hydro-Electric Board, with two certainly vocal and perhaps influential organisations demanding a re-evaluation of the Board's plans. At root, the criticism is the old one: is hydro generation economic in terms of capital, or of social cost in interference with scenery? The facts are available for the cost question and they do not seem to leave great scope for debate. With hydro generation, some 95% of unit sent-out costs are attributable to capital. The range of station costs, £125 to £200/kW, gives 0.65d to 0.85d/kWh at station busbars. Today's best steam station can equal the lower figure, tomorrow's might better it if fuel prices remained unchanged—provided the distance from the pithead or oil refinery to power station

is small. But in North Scotland such distances are large, especially in the north east, where industry is concentrated, and in the crofting areas, where distribution schemes bring hope of rehabilitation. If thermal stations in the south are to be relied on for northern supplies, then substantial transmission costs must be faced. These will soon hoist the apparently favourable thermal station economics nearer the hydro levels. Even in the comparatively easy transmission routes of England a double-circuit 275 kV line to give 550 MVA firm transmission capacity costs £25,000/mile, about £4 10s/kVA/100 miles. The cost of terminal equipment must be added and transmission losses capitalised for the hundred-miles transmission that would be needed for south to north power flows. In fact, the pattern of energy demand fits in well with nuclear base-load generation (having low fuel transport costs) and hydro back-up, with capital cost lessened because it will no longer be necessary to squeeze out the last expensive kWh of dry-year firm energy through extending storage capacity. That, then, is the technical background to demand for a new inquiry. But there is a political angle as well. All of this has already been looked at in detail by MPs, who, through the Select Committee on Nationalised Industries, gave the N of S HEB a most satisfactory report. If that Committee is to mean anything, then a renewed look at North of Scotland plans cannot easily be granted.

RAIL ELECTRIFICATION DITHERING

Railway finances are again causing concern at Ministerial level. There is nothing new in that, but last week's debate in the House of Commons indicated that the Minister of Transport has been driven to decisions on the subject that are of direct importance to electrical manufacturers. As part of yet another reappraisal of British Transport Commission's plans for the railways, contract placing for the Euston-Birmingham-Crewe electrification is to be brought to a stop, although existing contracts are not to be affected. The implication is that plans to electrify this part of the railway system may be abandoned or placed in cold storage, the place of electric locos being taken by diesels. This seems a decision occasioned by political cold feet. Even if it is thought that the original decision against dieselisation was wrong, on a narrow economic basis, preparation for electrification has gone so far that the only sensible step to take is to press ahead with it as fast as practicable so that a financial return may start being earned on the investment already made. That was the view of the Parliamentary Select Committee whose critical report was largely responsible for last week's debate. It must also be the opinion of all who study the problem away from the pressures of political expediency. In fact, in the long run electrification looks right, granted that some sort of railway scheme is going to be retained for the foreseeable future

(and that is explicit Government policy). The heavily loaded London - Birmingham - Crewe - Manchester-Liverpool main line is a natural for electrification. As the designers of the BTC modernisation plan put it, after predicting that either dieselisation or electrification would pay from the commercial aspect, "in many ways electricity is the ideal. On the lines of heaviest traffic the potential economies are less with diesel traction than with electrification."

CONTROLLABLE LOADS

That an unlimited supply at the declared voltage and frequency should always be available is an attractive ideal for electricity supply, but it is far from being an aim in the economic interests of the consumer. The increase in interest in providing for interruption of suitable supplies at short notice is a rapidly growing auxiliary to the broader brush of off-peak loading as a means to matching lower cost electricity to load possibilities. The predictions of South Wales EB speakers at the recent EDA Industrial Sales Conference are notable in this respect. They envisage between 150 MW and 200 MW of controllable load in the area in a few years' time, compared with an area board peak demand of about 1,500 MW. That represents a prize worth sustained effort.

ANALOGUE ADVANTAGES

Digital computers offer so much in sheer speed of computation today that the time-consuming business of programming them for given tasks tends to be discounted, with the consequence that analogue devices are readily regarded as outmoded. In the specific field of electrical network analysis, however, the case is not proved. The conventional network analyser in one of its forms still competes effectively with the electronic digital computer. The article which begins opposite looks in detail at the network analyser facilities which are now available at CEBG headquarters. Installed there are a d.c. analyser, used for the first essay in a study, and a highly refined a.c. analyser which offers greater precision and more flexibility of application. Speed of setting up and operation are the criteria of success of instruments of this nature, and in consequence a large number of aids to the operator has been built into the a.c. equipment. Yet it is still capable of significant extensions in this respect, for instance by incorporation of automatic balancing. This can go far to offset the greater speed of the digital computer in the actual computational process. There is another factor in favour of the analogue computer in the system engineering context. It keeps the problem at least perceptibly associated with the physical and geographical shape it assumes in practice, and this makes it a more educational and perhaps more congenial instrument for the engineer than the digital computer.

Meteor

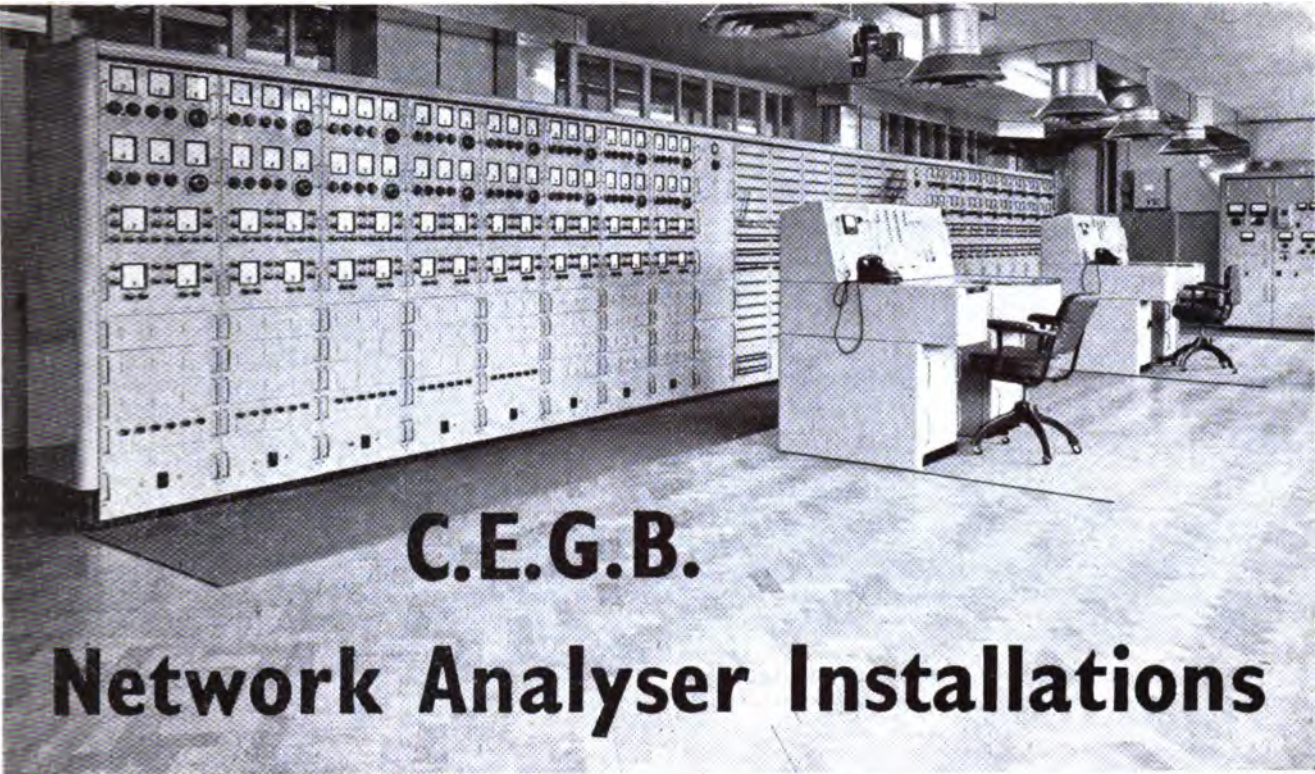


Fig. 1, above, shows the a.c. analyser installation

PART 1. HEADQUARTERS INSTALLATIONS

by A. W. Hales,* A.C.T.(B'ham), A.M.I.E.E., A.M.Brit.I.R.E.

As a consequence of the nationalisation of the electricity supply industry in 1948 and the creation of the then British Electricity Authority, a more unified approach to the design and development of the high voltage transmission system within the Authority's area became possible. This situation, together with two other factors (the continued growth in the demand for electricity during the post-war years and the necessity for overtaking arrears in system expansion occasioned by the limited amount of man power and capital that was available for this purpose during the war years), resulted in an intensification of activity in the sphere of high voltage transmission system design. Additionally, modern developments in turbo-generator and ancillary plant, e.g., excitation systems, automatic voltage regulators, etc., combined with the growing importance of system loads of a hitherto unusual character (e.g., large arc furnaces, nuclear fuel processing installations, colliery winding equipment, etc.) occasioned an increase in the volume of analytical work that was required to be undertaken in evolving suitable transmission system designs.

Some indication of the degree of expansion in the electricity supply industry, with particular reference to transmission equipment, is shown in Fig. 2, which depicts the annual growth in installed generating capacity, grid transformer capacity and overhead line route miles for the decade 1949-1959. In assessing the extent of the trends, it should be noted that the data does not include that of the South of Scotland Electricity Board, which was

created in 1955. The influence of the additional problems created by post-war developments and increased complexity of interconnection of the high voltage system demonstrated the necessity for the enlistment of such computational aids as existed in the work of the then Authority's transmission design branch. The use of such computational facilities for transmission design work, which already existed in certain large electrical manufacturing organisations and elsewhere, showed a progressive increase which was maintained with the passage of time.

* Mr Hales is with CEGB Headquarters.

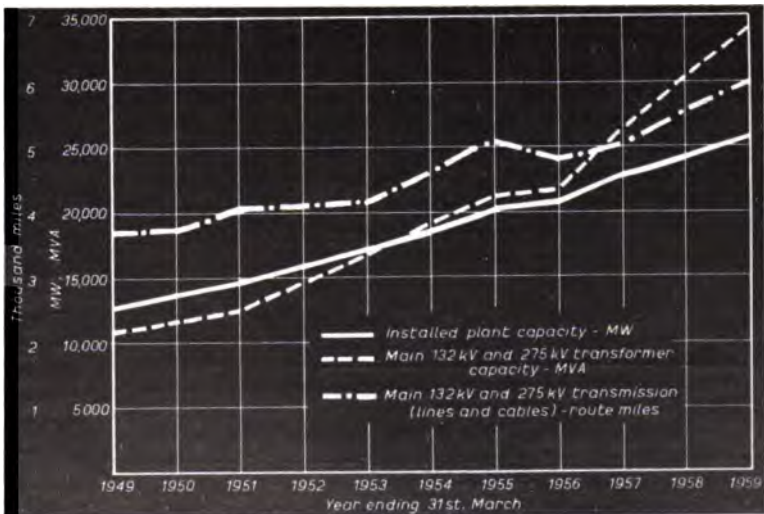


Fig. 2. Plant capacities and transmission distances, 1949-59

Accordingly, in 1952 it was decided to embark upon a programme of network analyser development and construction in order to equip the transmission design branch at headquarters with both d.c. and a.c. network analyser facilities. This programme was subsequently fulfilled, together with an additional and later programme which related to the development and production of 50 c/s a.c. network analysers[†] which were intended more particularly for use within the regions, divisions and area boards. In the case of the latter, there was a considerable number of d.c. network analysers, mostly of differing design and construction in operation. The individual designs were calculated to serve best the local and sometimes specialised applications for which they were built, but such is the diversity of design, etc., that it is impracticable to comment at length, and it is not proposed to deal with these equipments in these articles.[†]

Concurrent with the above-mentioned projects there have been other successful developments directed towards the production of economic a.c. network analyser equipments, which supplement the equipments described herein. It is not, however, proposed to discuss these developments since they have already been treated elsewhere.^{2,3}

The functions of the headquarters equipments are essentially complementary, the d.c. analyser being employed for rapid studies of a preliminary character not requiring maximum precision and data, but which nevertheless serve to formulate ideas on the probable course of development of a transmission scheme. Following preliminary studies on the d.c. network analyser, a convergence of ideas and possibilities on a particular study is possible and once the broad outline of a feasible or preferred system is known the study can then be transferred to the a.c. network analyser for a more comprehensive treatment having a higher order of precision if such a course is considered necessary.

D.C. Network Analyser

This was the first equipment to be completed and was designed primarily for the determination of transmission system power flows and fault currents. Additionally, it can be used for general network reduction purposes, for circuit-breaker and protective gear application problems, for fault location purposes and for line outage studies. The analyser may be used for fault studies by applying methods based upon symmetrical component theory, where the configuration of the interconnected sequence impedance networks permits the system equations to be completely satisfied. Various techniques to extend the application of this type of analyser have been evolved.^{4,5}

The analyser, an illustration of which is shown in Fig. 3, is of the resistance type, being energised from a d.c. source and completely universal in application. The principles of the d.c. current distribution, etc., in passive networks of this type as applied to a.c. power system analysis have long been established and employed, and it is sufficient here to say that they are primarily based on the following two simplifying assumptions:

1. That all system e.m.f.s are equal both in respect of phase and magnitude, and
2. That all system impedance phase angles are equal (in the usual case equal to 90°).

In those systems where the series impedances have a

[†] The series will comprise three articles outlining the general conception of the design and construction of three separate classes of equipment, namely, the d.c. and a.c. network analysers located at the Board's headquarters and the numerous 50 c/s a.c. network analysers which are now in service in various regions, divisions and area boards, etc., throughout the country.

predominantly reactive character, as is the case with the Board's high voltage transmission system, it is often sufficiently accurate to represent the complex system impedances by equivalent resistances which represent, to some scale, the actual inductive reactive elements. With the equipment X/R ratios commonly encountered, the error introduced by this simplification is of the order of 5%, i.e., current values are increased in magnitude by approximately 5%.

In this analyser two separate passive networks are incorporated, one being for use in power flow studies, and the other for use in fault studies. This feature is necessary if optimum scaling of the networks is to be achieved when using a common supply voltage for both types of study. For this reason the ratio chosen between the network scaling factors is 100:1, the individual network scaling factors being as follows:

- (a) Power flow studies: 5 ohms=1% reactance on 100 MVA base, and
- (b) Fault studies: 500 ohms=1% reactance on 100 MVA base.

The corresponding current relationships in the two networks are: 1 milliampere=1 MW and 1 milliampere=100 MVA, respectively.

For condition (a) above the passive network is energised from a d.c. three-wire 50-0-50 V supply, whilst for (b) a similar two-wire 50 V supply is used. From Fig. 2 it will be seen that the analyser consists essentially of two main groups of equipment:

- (1) An in-line arrangement of racks containing various types of functional unit as follows:

- (a) network infeed units.
- (b) network universal impedance elements.
- (c) central unit termination and interconnection panels.

- (2) Two metering and control consoles.

The upper halves of the extreme left- and right-hand sections contain the network infeed units, whilst the corresponding lower sections contain the network universal impedance units.

Functional Units

A network infeed unit consists of a switched resistor network in parallel with a potentiometer. The former contributes equal increments of network current, whilst the latter provides a continuous adjustment between the incremental values. The parallel resistor group is connected in series with a milliammeter, the latter giving a continuous indication of infeed current magnitude. A selector switch permits a unit to be selected for one of three functions.

- (1) As a "generator" or fault unit.
- (2) As a "load" unit, or
- (3) For presetting calibration.

The position (3) provides a rapid initial calibration feature with the unit energised at the nominal supply voltage. The total range of infeed is equivalent to 0-150 MW or 0-1,500 MVA for the load and fault networks, respectively. A 1 ohm precision shunt is permanently connected in series with each unit for network measurement purposes.

The universal impedance units contain two separate groups of resistor networks comprising three decades each, a panel switch providing group selection. The total range traversed by these units in 0-1% increments is equivalent to 0-99-9% reactance on 100 MVA base. The unit calibration is directly indicated in terms of per cent impedance on 100 MVA base by rotating dials at the rear of the panel. All the resistive components have a nominal tolerance of $\pm 1\%$. A 1 ohm precision shunt is connected

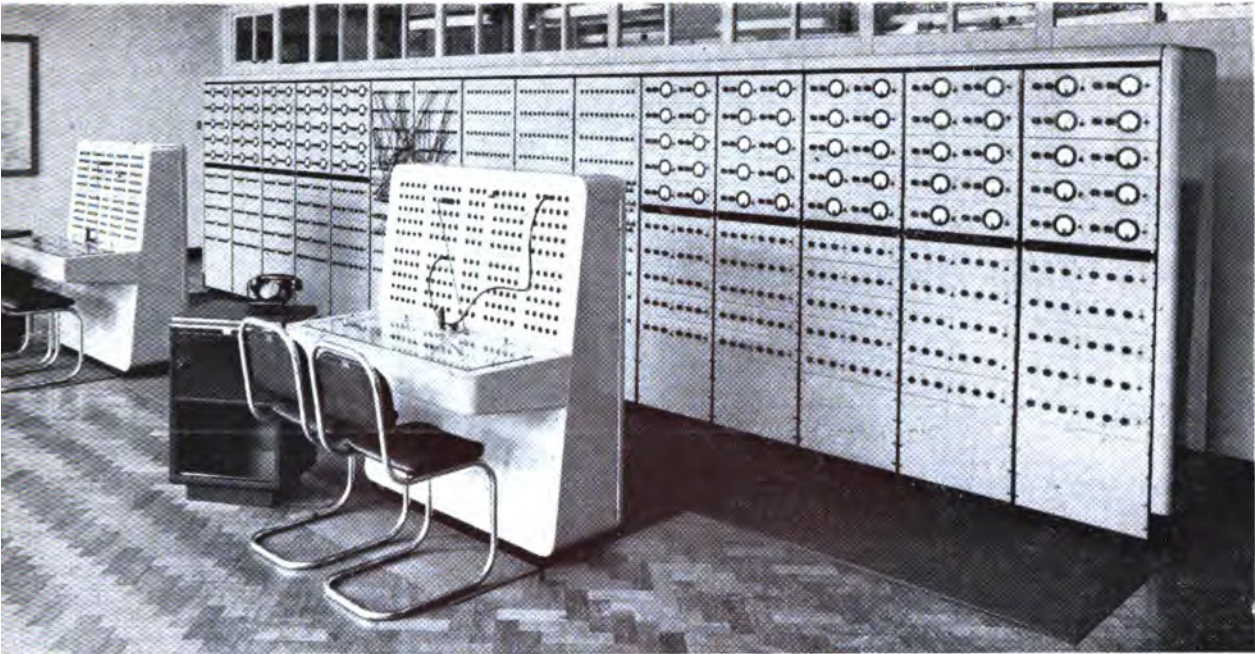


Fig. 3. D.C. network analyser installation, showing operating consoles

ries with each unit for network measurement
ses.
e centre section of the main equipment racking con-
the facilities necessary for unit terminations and
interconnection to form any desired equivalent
n network. Any two termination sockets on the main
connection panel may be connected together by
oning them in adjacent plugs. In this way, sections
alyser bus may be constructed as necessary. A space
re vacant plug serves to isolate one section of bus
another. Designation strips are provided for the
fication of system locations.

ering and Control Facilities

l network measurements are effected at either or
of the metering and control consoles. The analyser
thus be operated as two independent channels or as one
osite unit as required. All network current measure-
s are obtained by measuring the millivolt drop
oped across the precision shunts referred to pre-
ly. For current measurements, two precision grade
e-zero (5-0-5 millivolt full-scale deflection) millivolt-
rs are employed. The ranges of measurement
able are as follows:

r Measurement	Range 1	50-0-50 MW
	Range 2	250-0-250 MW
	Range 3	1,250-0-1,250 MW
t Power asurement	Range 1	500-0-500 MVA
	Range 2	2,500-0-2,500 MVA
	Range 3	12,500-0-12,500 MVA

onnection to the functional unit shunts is effected
ally on the inclined panels of the control consoles,
n in Fig. 3. By using two instruments, the total fault
er and a single branch fault power contribution may
obtained simultaneously. A system of coded inter-
ection plugs used in conjunction with an instrument
ction convention enables the direction of current flow
network unit to be determined readily from the centre-
instruments. A voltmeter is incorporated for the
urement of supply voltages and the voltages
loped between specified nodes in the interconnected
ork. Facilities are included for the energising of

special-purpose isolated networks, e.g., complex networks
requiring reduction. Groups of pre-calibrated, fixed infeed
units of extended range are included for use in studies
which would otherwise require the use of multiple
standard infeed units in parallel. With these units single
loads of up to 1,000 MW or fault powers up to 10,000
MVA may be obtained directly.

Power Supply

The analyser is supplied from two constant potential
metal rectifier units connected in series so as to provide a
three-wire d.c. 50-0-50 V supply for the fault network.
They have a current rating at nominal voltage of
1,500 milliamperes, the ripple content of the output voltage
being approximately 0.5% at a current of 1,000 milli-
amperes.

A.C. Network Analyser

The development and construction of the a.c. analyser
followed chronologically on the commissioning of the d.c.
network analyser, and several operational features incor-
porated in the latter which experience indicated were of
merit were included in its design. An illustration of the
analyser is shown in Fig. 1, which indicates the compact
and logical layout which has been achieved. Like its d.c.
counterpart it is designed for dual channel operation and
essentially constitutes two separate network analysers. Its
complement of functional units (divided equally between
the two channels) is as shown in Table 1. The design and
construction of the main equipment was preceded by the
development of a "pilot" section which was used as the
basis of the final design. Much valuable information was
obtained in this way which proved to be of considerable
value in the later work, even though the ultimate per-
formance of the final equipment could not be gauged in
all particulars until its construction had been completed.

Fig. 4 indicates in schematic form the disposition of
the equipment, and from this it will be seen that the
primary source of supply (1,000 c/s) is an oscillator unit.
The output of this is fed into a phase conversion unit
having a two-phase output, this providing the input signal
for two power amplifiers whose load consists wholly of
Magslip resolver stator windings. The resolvers are used

Table 1. Analyser_unit facilities and ranges

Type of Unit	Total Number Installed	Range	Increment
Generator	32	Phase Angle 0 - 360° Output Voltage 0 - 2.5 per unit Output Current 0 - 6.25 per unit	{ Continuously Variable
Load Impedance ...	64†	Real Power 0 - 2.09 per unit Reactive Power (Lagging) 0 - 2.19 per unit Reactive Power (Leading) 0 - 0.99 per unit Autotransformer ratio 1 : 0.80 - 1.20	0.01* per unit 0.01* per unit 0.01 per unit 0.01
Line Impedance ...	162	Resistance } Series { Individual calibrated units Inductance } selected for given total value Capacitance-Shunt	— — —
Autotransformer ...	30	Voltage Ratio 1 : 0.80 - 1.20 Resistance } Series { Individual calibrated units Inductance } selected for given total value	0.01 — —
Coupling Transformer	24	Various Ratios 1 : 1 (16) 1 : $\sqrt{3}$ (4) 1 : 2(4)	—

* Except between 1:00 and 2:00 per unit positions. † Leading reactive load facilities on 32 units only.

in this instance purely as sources of continuous phase shift. The variable phase voltage, derived from the rotor of each resolver, provides (via a variable attenuator network) the input for the respective generator unit amplifiers—which feed directly into the passive complex impedance network. Various ancillary features are also included for maintenance, setting operating levels, etc., in the 1,000 c/s supply chain.

The base operating or one per unit values of the analyser are as follows:

Voltage: 25 volts	Impedance: 500 ohms
Current: 50 milliamperes	Admittance: 2 millimhos
Power: 1,250 milli VA	Frequency: 1,000 c/s

For convenience the applications of this type of direct impedance analyser may be itemised as follows:

- (1) Operational studies on systems under "normal" conditions.
- (2) Operational studies on systems under specified fault conditions.
- (3) Steady-state stability studies.
- (4) Synchronous machine transient stability studies by the step-by-step method.
- (5) Asynchronous machine stability studies.
- (6) Non-electrical problems which can be solved by an electrical analogue.

adjustment of generator unit output voltage phase and magnitude—the question of the desirability and means of automatising these functions being deferred until a later stage. The complete analyser contains 522 valves and has a mains power consumption of approximately 9 kW. For environmental reasons it is located in an air conditioned room, having its own self-contained air conditioning plant. The plant has a nominal capacity of 4,000 cu ft/minute and is specified to maintain the ambient temperature at $70^{\circ}\text{F} \pm 1^{\circ}\text{F}$ with a maximum relative humidity of 60% under all expected extremes of seasonal conditions. The installation incorporates both glass wool filters and electrostatic precipitation plant in order to reduce the deposition of dust in the equipment, the latter operating at a nominal voltage of 12 kV d.c.

Outline of Equipment and Performance

The selection of the nominal base operating quantity was, as is usual in such cases, a considered compromise between many conflicting factors. The availability of magnetic materials, the design of amplifiers and instrumentation equipment, the physical size of network components, the effects of stray electromagnetic and electrostatic coupling, etc., were some of the important points requiring assessment. It is sufficient to note that the operating frequency of 1,000 c/s was chosen because it reduced the physical size of the reactive network components to acceptable proportions, was sufficiently low so as not to introduce significant effects on performance and accuracy due to parasitic coupling, and had the merit of being easily verified by comparing it with the GPO 1,000 c standard tone.

Generator Units

A schematic of a generator unit shown in Fig. 5, from which it will be noted that the main element is high-performance feedback amplifier with which is associated a composition metering system giving direct indications of real and reactive power output at the unit terminals. The amplifier has both negative voltage and current feedback applied overall, the latter permitting the attainment of virtual zero output impedance and

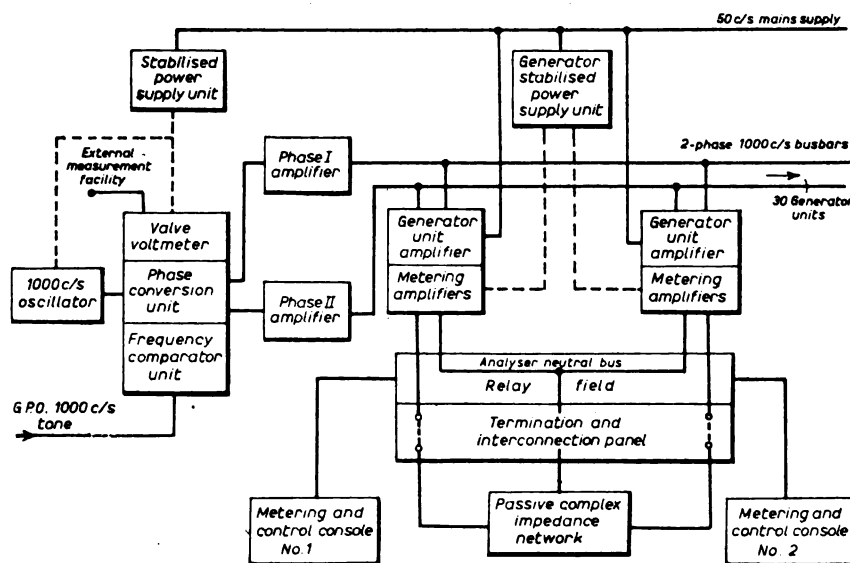


Fig. 4. Schematic functional layout of a.c. network analyser

conditions of unity power factor load. Variations in output impedance under normal designed loading conditions are such that it traverses the range 0-1,250 milliohms for power factors between zero lag and lead. The total amount of feedback applied is approximately 26 dB. The adjustment of output voltage is effected by a switched attenuator network having for its fine control a ten-turn helical potentiometer. This attenuator network precedes the main amplifier and is energised from the rotor circuit of a Magslip resolver having two-phase stator and rotor windings. Independent variation of phase of output voltage is effected by the resolver through the range 0-360°. Its rotor is driven via a slow-motion dial assembly having ratios of 50:1 and 1:1, respectively. It incorporates a vernier scale, thus permitting an angular resolution of 0.1° to be obtained.

The main amplifier output stage operates in Class A push-pull and is capable of delivering a total power output of 12 watts with a total harmonic distortion level of less than 0.1%. The power output available at the generator terminals is less than nominal by the amount consumed by the wattmeter and varmeter shunt operating coils.

The ancillary metering amplifiers comprise two virtually identical channels, i.e., for real and reactive power measurement, respectively, the latter differing only in that it has additional phase shifting circuits. Both amplifiers have identical single-ended output stages (6 BW 6) with overall negative current feedback applied over the output and penultimate stages. As a consequence, they have a relatively high output impedance (3,700 ohms). This high value of output impedance minimises the errors due to the finite mutual coupling that exists between the fixed and moving systems of the dynamometer type indicators.

Facilities are provided in these units for the insertion of mobile circuit monitoring equipment to assist in their rapid servicing. For analyser studies requiring the representation of various forms of generator internal impedance, a unit is used in conjunction with a line impedance unit.

Line Impedance Units

These units are constructed in drawer form, each containing three line impedance units and mounted on telescopic runners. Each drawer contains six rows of nylon-loaded P.F. octal type valve holders—two rows per line impedance unit—these being interconnected so as to receive plug-in impedance elements of three basic types, i.e., series resistance, series inductance and shunt capacitance. The mode of interconnection ensures that all series and shunt connections are formed automatically. With this system a wide range of equivalent circuits having a correspondingly wide range of constants can be assembled since the insertion sequence of impedance elements is entirely flexible. It is thus possible to cater for special cases, e.g., induction motor equivalent circuits, as circumstances require. Unit designation labels for recording the constants of the equivalent circuits are provided on the front panels. Initially, the impedance element constants were selected so as to cover the com-

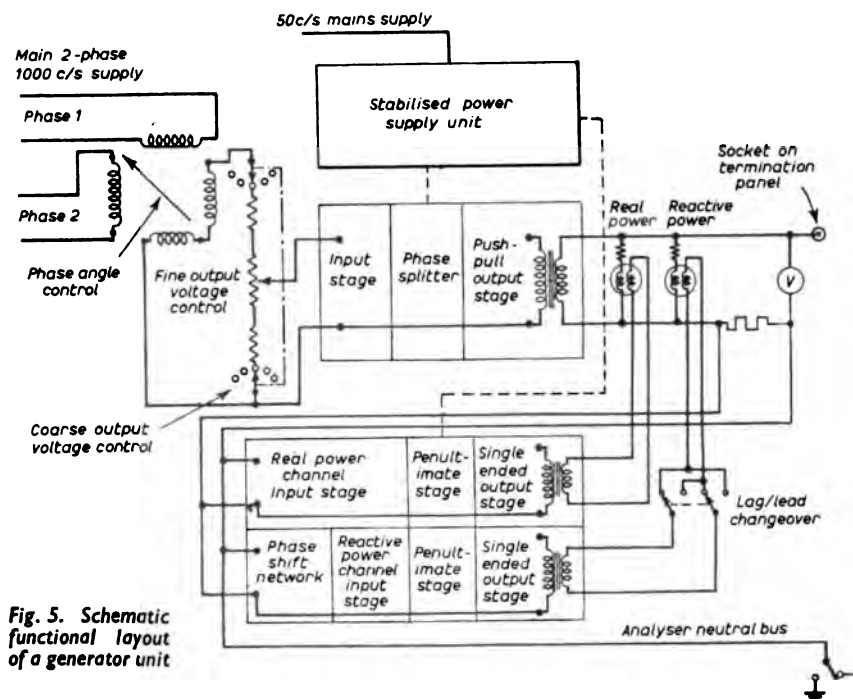


Fig. 5. Schematic functional layout of a generator unit

monly expected range of system constants, though as experience and changing circumstances indicate, new values can be added. The nominal values of the impedance elements contained in the initial installation are as shown below:

- Resistance: 0.001, 0.002, 0.003, 0.004, 0.005, 0.006, 0.007, 0.008, 0.009, 0.01, 0.02, 0.03, 0.04, 0.05 per unit.
- Reactance: 0.001, 0.002, 0.003, 0.004, 0.005, 0.006, 0.007, 0.008, 0.009, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.90, 1.00 per unit.

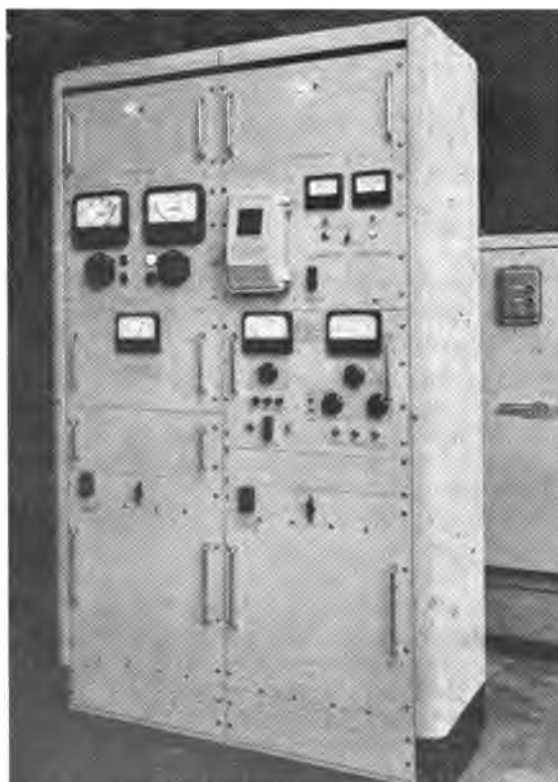


Fig. 6. Power supply equipment for a.c. analyser

(c) Susceptance: 0.001, 0.002, 0.003, 0.004, 0.005, 0.006, 0.007, 0.008, 0.009, 0.01, 0.02, 0.05, 0.10 per unit.

The resistors and capacitors are of the wire-wound and silvered-mica types, respectively, having a nominal tolerance of $\pm 1\%$. The inductor design is based on pot core assemblies using Ferroxcube as core material. The core size employed enables the range of inductance values envisaged to be adequately covered whilst at the same time permitting an acceptable Q level to be maintained. The specified inductance tolerance in the working current range up to 312.5 milliamperes is $\pm 1\%$ of the nominal value, whilst the Q values range from 15 to 35 depending upon inductance value.

When not in use the individual impedance elements are stored in three mobile racks adjacent to the analyser. One of these racks includes a mobile circuit monitoring equipment for the routine checking of generator and power amplifier unit valve operating conditions.

Load Impedance Units

These units furnish facilities for real and reactive power representation in the network, half the units (32) catering for both lagging and leading reactive power conditions. The facilities and respective ranges covered by these units are given in Table 1. The actual parallel-connected load impedance branches are supplied from the primary of an autotransformer which has a tapping range, in 0.01 per unit increments, of 0.80 to 1.20 per unit volts with a secondary voltage of 1.0 per unit. The voltage across the combined load impedance is monitored by a suppressed zero voltmeter having the same nominal voltage range as the primary winding of the autotransformer. The resistive branches of the impedance are switched ranges of carbon or wire-wound resistors (depending upon ohmic value) having a nominal tolerance of $\pm 1\%$. The inductive branches employ two Ferroxcube pot core assemblies having multi-tapped windings. The Q value at any tapping covers the range 32 to 122 depending upon inductance value. Where fitted, the capacitive branches comprise switched banks of silvered-mica capacitors, also of $\pm 1\%$ tolerance.

The autotransformer core assembly is also of Ferroxcube—being formed from eight U-shaped sections. The small magnetising current of each transformer is compensated by an individually selected shunt capacitor connected across the secondary winding. The no-load loss at unity ratio is approximately 1 milliwatt.

All indications on a unit, e.g., load settings, transformer ratios, etc., are by means of rotating engraved dials positioned directly behind apertures in the front panel.

Autotransformer Units

Constructionally these units are similar to the line impedance units and utilise the same principle of impedance element insertion for the representation of transformer leakage impedance and no-load admittance.

The transformers are identical in all respects with those used in the load impedance units.

Coupling Transformers

These transformers are provided for the interconnection of system sequence impedance networks in fault studies where simultaneous system faults or other applications involving inter-circuit mutual magnetic coupling arise. Three ratios are employed, namely: 1:1, $1:\sqrt{3}$ and 1:2.

The design of a transformer for this function is essentially a compromise, for though they should be "ideal," i.e., possess zero losses, have zero leakage impedance and

no inter-winding or inter-turn capacitance, a practical design must clearly fall short of the ideal. Design investigations resulted in the selection of Ferroxcube as core material and this, together with the choice of a liberal nominal rating, has enabled a satisfactory design to be evolved, without having recourse to the inclusion of loss compensating equipment.

Having regard to the general conditions which obtain in most applications of these transformers, it was not considered economically justifiable to incorporate ancillary loss compensating equipment. The transformers are, however, compensated for magnetising current by shunt capacitors. The windings, which are of circular section enamelled copper, are sectionalised to reduce leakage reactance to an acceptable minimum.

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(The next two articles in this series will deal with instrumentation of the analysers described and with analysers in CEBB regions and divisions and at air-boards.)

CARRIER PROSPECTS

FUTURE prospects for the more and more compact handling of messages in telecommunications carrier systems were discussed by the IEE Electronics and Communications section chairman, Mr. T. B. D. Terroni, B.Sc., M.I.E.E., in his inaugural address last week. His background was the international agreement, aimed at securing good quality speech transmission over circuits up to 2,500 km long. This implies provision of speech circuits having controlled response over the band 300 to 3,400 c/s so that speech channels of 4 kc/s nominal bandwidth can be assembled in blocks of 12 in the frequency range 60 to 108 kc/s. These basic groups are built up into supergroups of 60 channels, which are next assembled in blocks of 300 channels to form a mastergroup, and then 900-channel supermaster group covering the frequency range 8,516 to 12,388 kc/s.

Many techniques are brought into play to secure the compression of information. Looking to the future, Terroni discusses in particular time sharing rather than wavelength sharing, with special attention to pulse code modulation. The aim of this technique is to send high speed telegraph pulses to represent speech. The pulses obtained by sampling the speech amplitudes at a frequency equal to at least twice the highest speech frequency to be transmitted, i.e., 8,000 c/s. The instantaneous amplitudes thus determined are transmitted in code as digits in a binary system. Such a system would be less liable to interference than with other methods, and cable requirements are less stringent.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Late Deliveries

AS my company purchase a considerable quantity of equipment, both electrical and mechanical, and experience considerable delays in construction due to delivery promises being repeatedly broken, I was somewhat amused to read the reply by BEAMA to the Australian High Commissioner's comments regarding this very serious disease which British industry is at present suffering.

My company could supply BEAMA with many examples of broken delivery promises, but the following probably illustrates my point very clearly.

An order was placed with a very large concern for some starters. The order was dated February and the delivery promised within 26 weeks. Our progressing section extracted the following information during the year:

April—Confirmed delivery end of July.

May—A letter was received confirming 5 August delivery.

End of July—We are told no "accurate" date of despatch available. At this stage this equipment is urgently required on site and it is being constantly progressed.

End of August—Definitely promised on site by end September.

Early September and throughout September—Confirmation received end September delivery.

End of September—Despatching 4 October.

4 October—Despatching 7 October.

7 October—Manufacturer finds he is unable to fit one starter above the other on the busbar chamber.

Eventually delivery was effected by special transport on 15 October.

As a patriotic Englishman I view complacency on the part of responsible associations with great concern, and shudder to think how we are going to stand up to the economic breeze, which no doubt will develop into a fairly strong gale, when the Six and Seven finally get together.

H. J. Wilson, M.I.MECH.E.,
CHIEF CONSTRUCTION ENGINEER,
MONSANTO CHEMICALS LTD.,
LONDON S.W.1.

Jumping for Safety

I FOUND your recent article on industrial safety very interesting. H.M. Inspectors of factories suggested fitting d.p. switches and insulated handles to portable apparatus, especially to protect workers who are at some distance from others. This is a step in the right direction but meantime the danger remains. May I be allowed to place before you this small further contribution to industrial safety.

While working alone I became attached to live portable apparatus. Being of a rather placid nature, I put in some rapid thinking as my personal survival became more and more important. At the moment when I had decided that having made my living by electricity, it was probably right and proper to die by electricity, I had an inspiration. My fingers, of course, would not open as long as electricity flowed through hand, body and feet to earth. Through feet to earth? At this point I had found my answer. My feet were not paralysed, all I had to do was to leap in the air, stopping the current to earth, and so be able to open my hand. The answer is so simple that I almost cringe as I write it down as I have spent a lifetime in the electrical

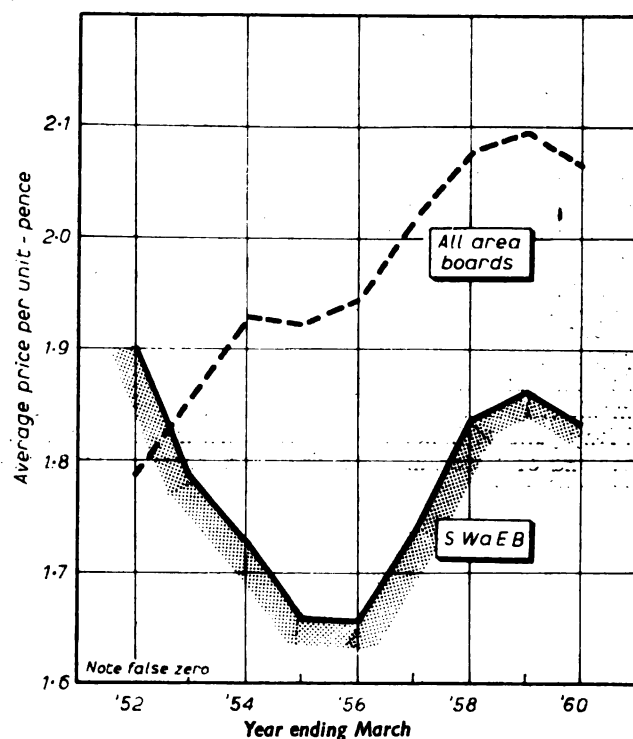
industry. I have noticed that most people who receive an electrical shock under similar circumstances fall to the ground during the fight to free themselves. It is of first importance in public safety that employees when in danger must stay upright and so be ready to be "One jump ahead of danger."

At all factories and even homes a campaign should be run by poster and slogan (as above) to drive this simple means of escape home.

C. McAllister,
GLASGOW.

Charges for Commercial Supplies

IN the Editorial in your issue of 20 October, 1960, you refer to the fact that: "In the case of South Wales, the commercial revenue per unit was actually less in 1959-60 than in 1951-52." While this statement is true, the inference which you draw is rather misleading. To put the matter in proper perspective it is necessary to consider what happened in the intervening years.



Average revenue per unit sold for South Wales EB and all areas

The accompanying diagram shows the average revenue per unit sold for commercial purposes during each of the years 1951-52 to 1959-60, inclusive, for the South Wales EB, and also for all area boards combined, and it will be observed that during the past four years of the period under review the curve for South Wales follows very closely the shape of the curve for all area boards.

The Board's first standard charges for commercial supplies came into operation on 1 April, 1952, and the average price of 1.903d during the year 1951-52 was that yielded in the last year during which the 94 separate commercial tariffs of the vested undertakings were in operation.

During the three years following the introduction of standard tariffs, there was a substantial increase in the average annual consumption of commercial consumers. The reduction in the average revenue per unit sold for commercial purposes during those years was undoubtedly the result of the considerable increase in the proportion of units sold at the final or follow-on rate.

Although during the next three or four years the proportion of follow-on units continued to increase (but at a lower rate) the effect of this was more than offset by tariff increases and by increases in the cost of fuel via the fuel adjustment clause of the commercial m.d. tariff, with the result that the average price per unit increased.

During the two years 1958-59 and 1959-60 there was no significant change in the cost of fuel in South Wales, nor was there any other disturbing influence, with the result that there was very little variation in the average revenue per unit sold during these two years. The slight fall in 1959-60 can be ascribed to the fact that the proportion of units sold at the follow-on rate during the year rose appreciably.

As you are no doubt aware, in order to cover increased costs the South Wales EB published new tariffs which became effective on 1 October, 1960, and the changes in

the commercial tariffs are such as will yield an appropriate contribution towards the Board's increased expenditure.

In conclusion, I cannot accept the implication of the last sentence of your article that the average revenue per unit of commercial supplies should necessarily move by year uniformly with that of other classes of commercial supplies. A great deal depends on the load factor and the coincidence factor in the respective classes. Nor is there any reason why the average price per unit of a particular class should not move in a downward direction. Provided the final unit price in the tariff adequately covers the cost of the incremental consumption which it represents, a progressive reduction in average revenue per unit indicates that the tariff is promotionally sound.

A. J. Dalton, A.M.I.E.E.,
CHIEF COMMERCIAL ENGINEER,
SOUTH WALES ELECTRICITY BOARD, CARDIFF

Meteor did not wish to imply, as Mr Dalton suggested, "average revenue per unit of commercial supplies move . . . uniformly with that of other classes." The statement used was "little justification for this falling behind other classes on commercial units." This was intended to suggest that the factors as those mentioned by Mr Dalton were not sufficient to account for the smaller rise in revenue per unit of commercial supplies.—Ed.

SPEED IN NUCLEAR SAFETY

ONE of the problems of the nuclear energy industry is to check whether equipment or people have been irradiated above a given level. A "sequential" test procedure is often used, in which the time for which the test is applied is not fixed, but depends on the results obtained. This is appropriate since the generation of charged particles due to radioactivity is a random process, and the necessary size of sample for a given accuracy cannot uniquely be stated in terms of time.

One aspect of such measurements is discussed in a paper* read before the IEE Measurement and Control Section last week. The particular application involved is monitoring radioactivity on the hands of nuclear workers. Many pairs of hands have to be tested in a short time at the end of a working shift. Most are expected to be uncontaminated or only very lightly contaminated. An efficient test procedure should allow hands with little radioactivity to be tested rapidly, and the same applies to

any heavily contaminated hands. Only hands whose activity seems to lie close to the tolerance level need be tested in a period long enough to give high degree of statistical accuracy.

Old Design

Most existing monitors have used the type of circuit shown in Fig. 1. Counting is effected by accumulating charges Q of charges Q produced by each event, (e.g., emission of an electrically charged particle). This causes the voltage on the capacitor to increase. At the same time the current is fed at a steady rate into a capacitor C_2 . Both capacitors start to charge when switch S is open, and the test is terminated when either capacitor has acquired a pre-set charge. Thus all tests producing a "tolerance" decision require the maximum time allowed by the time limit of the C_2 setting.

New Method

The faster method discussed in the paper (Fig. 2) involves a steady current I flowing out of the counting capacitor C_1 at the same time as the charges Q flow in. The current I is a value which would just balance the charge entering capacitor C_1 if the pulse rate were exactly at the tolerance level. Thus the capacitor integrates the difference between the actual pulse rate and tolerance pulse rate. When the voltage across the capacitor rises to a pre-set value a dangerous situation is indicated; when it falls below a given value a satisfactory condition is expected.

The paper is concerned with discussing the statistical theory behind the two techniques and quotes experimental results showing substantial time savings by the second method, especially when most tests give a "satisfactory" result.

One disadvantage of the technique represented by Fig. 2 is that it may require an excessively-long test before a decision is reached with radioactivity close to the tolerance level. This defect can be overcome by applying a time limit to the duration of the test, and relatively simple techniques are available for doing this.

* Paper No. 3258 "Rapid Methods for Ascertaining Whether the Activity of a Weak Radioactive Sample Exceeds a Pre-determined Level" by E. H. Cooke-Yarborough, M.A., M.I.E.E., and R. C. M. Barnes, B.Sc.(ENG.), A.M.I.E.E., (UKAEA).

Fig. 1. Usual hand monitor technique. (i) basic counting circuit; (ii) basic timing circuit

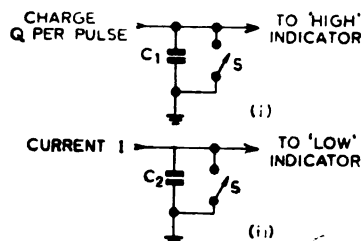
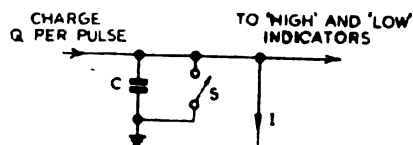


Fig. 2. Principle of difference integrator type of hand monitor circuit discussed in article



NOTES ON WIRING

BY M E G O H M

I READ the other evening about a proposed drive by manufacturers to cut out the "drudgery" in the home. This, according to my paper, is being tackled now at the drawing board stage, and by early next year the fight will be in full swing. All the giants in the field of manufacture are apparently lining up to invade the homes of Britain and install washing machines, spin dryers, garbage destructors, etc. etc. We are told that only 44% of our homes have washing machines, less than 31% have refrigerators and a tiny 8% have spin dryers. If the prices of these goods are attractive enough, then the scope looks really good.

Nobody, least of all myself, will be against this drive to make life easier. The only thing which worries me is whether the houses of Britain are adequately wired to receive these machines, which all require a point to operate them from and the correct voltage to make them run efficiently. Yes, it is an old subject, I know, but still a very serious problem to many of us. In many homes even now the purchase of a washing machine means some sort of bodged-up electrical outlet to serve it. Many new houses now being built will not help the situation, for these, in the main, are inadequately wired. It should be noted that this drive is wholly concentrated on the electrical industry, and if it succeeds then I can see the supply side of the industry meeting problems as well.

The drive is also going to concentrate on the lady of the house; if it impresses and convinces her then it no doubt will succeed. We engineers should make a sustained effort to convince the ladies that something should be done about providing an adequate number of sockets in the home. I hate to say it, but they seem to be "in charge!"

Fuses

My remarks concerning attempts to purchase a 30 A cartridge fuse prompted another question from a colleague. I was asked how many 13 A plugs in the country were correctly fused for the apparatus they were serving. A good question, don't you think? And a very difficult matter to check and rectify, if that becomes necessary. With the problem in mind I asked two neighbours if they would allow me to check their plugs as a matter of interest. Both agreed, and the results were as I expected. Neither had any real electrical knowledge and, therefore, relied on advice from the people they bought electrical goods from or their local electricity showrooms. One of the people concerned worked in London and had on occasions bought plugs in shops near his place of business and these plugs had 13 A fuses in them although their intended use had been explained to the supplier. One of these plugs served a wrought-iron table lamp by means of a twin-core flexible lead. To add to the danger, the flexible was knotted around one leg of the lamp so that it was hung "out of the way." Another plug, purchased for use on a kettle, had been supplied with a 2 A fuse and the correct fuse had been inserted only after the kettle had been taken in for repair because it blew on a similar-sized fuse.

My other friend was not quite so badly off, because he had a cutting from a monthly magazine which showed a

fair guide to the size of fuses which should be used on various pieces of electrical apparatus. Only one fuse was incorrect and that was in a spur-box serving a 500 W fixed heater in the bathroom. The fuse in the spur-box was of 13 A size.

Such problems are not easily solved, and even the attempts by apparatus manufacturers who state which size of fuse should be used with their goods very often fall on stony ground. Incorrect fusing can be a real source of danger and not easily detected until the damage is done.

Third Pin or Not?

A business friend of mine who knows little or nothing of electrical matters mentioned to me that the area in which he lives has just been declared a "smokeless zone" and that he had gone completely electrical for heating. In view of this, he had had "these 13 A things" installed and then proceeded to ask me the reason for the third pin on the plug. I carefully explained the reason for the third pin and how it was a safeguard for him when he used apparatus constructed of metal. He seemed satisfied, but then he turned to me and asked why the person who had been responsible for the connecting up at the meter position had suggested that a "two-wire system" would have been just as good.

As in so many instances of this nature, the exact identity of the person who made the remark was far from clear, and his reasons for the preference of two-pin sockets and plugs even less clear. Obviously, he expected his statement to be taken without argument.

I suppose there are a number of electrical engineers who consider a non-earthed system safer than one which earths all exposed metal, but I don't agree with them. There has been too much trouble with shocks when equipment supplied from sockets in "earth-free" positions has been used in "earth-fraught" areas.

Statements like those I quote leave doubts in the minds of such people as my friend for, as I see it, he consulted a contractor who advised a ring circuit, and when some alteration to the supply arrangement was necessary someone else contradicted the advice of the contractor. A sad mix-up indeed, and one which could be caused by one of many reasons, including prejudice, lack of real knowledge and false sense of authority.

I use the last description having in mind the meter-reader who once called (when I was out, needless to say!) and proceeded to look at all the switches, etc., and offered suggestions about a better type to have installed. I suppose he was slightly misled by the variety of different makes of switches fitted to my installation! But how else can one really comment on sample switches than to fit them and use them?

I know that many arguments and discussions could be based on the pros and cons of the earthed and non-earthed system. No doubt I shall hear some of them, and be involved in them, but I still think that the former is the safest. However, as in the case of the fuses, the ordinary person must be educated in the matter and this immediately raises the question of just how much should he, or she, be told.

Bradwell prepares for nuclear fuel

CHARGING MACHINE COMPLETE

THE FIRST of the two massive 400-ton machines which will charge and discharge nuclear fuel in the first reactor at Bradwell 300 MW station is now ready and we were recently able to see it in action. The machine operates in the 70 ft high charging room above the reactor pile cap. When handling nuclear fuel elements, operations will be controlled remotely from an air radiation-screened control room.

Finally, the station has assumed a more finished appearance with a cladding of aluminium and glass concrete. Most of the reactor shields, heat exchangers and auxiliary equipment. Laying of number one reactor core is complete and the principal remaining work on the reactor vessel is in connection with burst-slug removal equipment. Core laying in the second reactor will begin. All six gas circulators for the first reactor and their associated variable speeds turbo-alternators which give gas flow control, are virtually complete and have undergone preliminary tests. The three 52 MW turbo-alternators for number one reactor are also nearing completion, while work on the remaining three sets for the second reactor is well advanced.

The main control room where electrical, boiler and turbine controls are centralised, is in use for regulating power supplies from the grid for works auxiliaries. Control panels for the station auxiliaries are in use and the reactor and electrical instrumentation is in operation and awaiting tests.

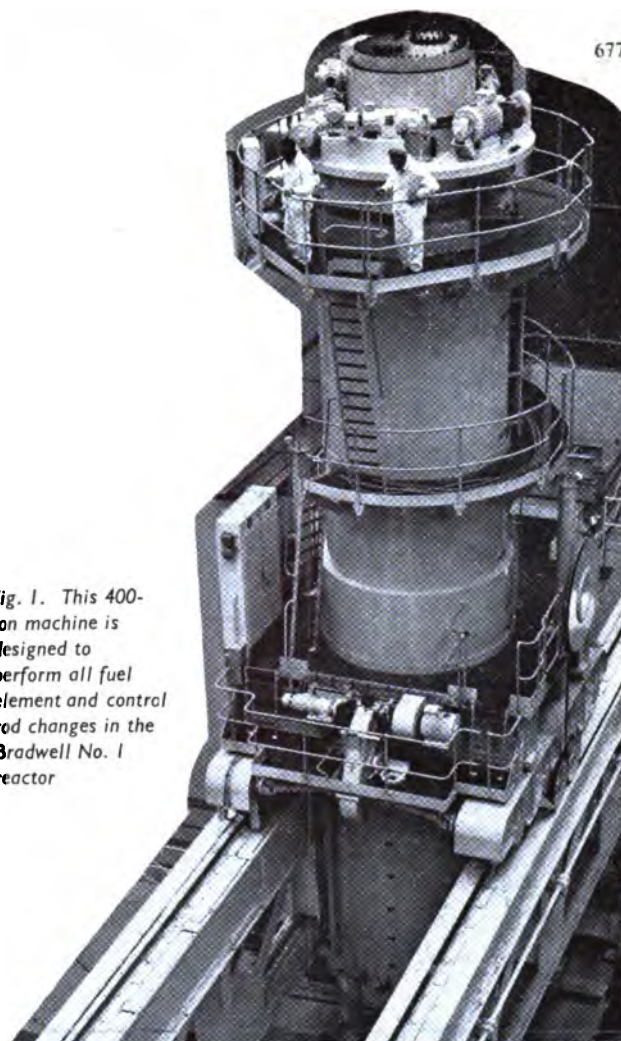
The first consignments of fuel are now arriving by road, and loading of the reactor is scheduled to begin in mid-December, 1961. During the three or four months that the station will take to work up from criticality to full load, operations will begin in the second reactor.

Handling Machine

Nuclear fuel and control rod changes in the reactor will be handled by a single machine, with a second machine kept on stand-by use. Each machine is 52 ft high and is supported by a gantry approximately 100 ft wide. The machines were designed and built by Strachan and Henshaw, who are building similar machines for Dungeness and the station at Latina.

The traverse movement of the machine and longitudinal movement of the gantry have a fast travel of 20 ft/min, while final positioning over a particular standpipe is by a charging chute lowered from the standpipe by a charging chute lowered from the standpipe. Before the charging chute is positioned, the standpipe must be raised and the standpipe radiation plug and gas seal must be established. After the charging chute is lowered into the reactor vessel, irradiated fuel may be removed element-by-element until a maximum of three

Fig. 1. This 400-ton machine is designed to perform all fuel element and control rod changes in the Bradwell No. 1 reactor



channels have been emptied. These elements are stored in the machine, which also has capacity for the equivalent number of unused fuel elements. The machine also houses two grabs driven by variable speed motors for fuel and control rod handling.

The electrical drives for the machine have been kept as simple as possible. High-speed traverse of the machine on the gantry is by a single 10 h.p. induction motor, while a 1 h.p. induction motor provides the creep speed. The gantry is driven by one 10 h.p. and one 1 h.p. induction motor at each end for the high speed and creep, respectively, and the motors are linked by a fly shaft. The drive pulls the gantry along chains laid in the pile cap floor adjacent to the running rails. The two hoists are powered by a.c. variable-speed 4/1 h.p. motors.

The combination of machine and gantry drives enables an operator on a platform at the base of the machine to position it over a particular standpipe, or above fuel storage, maintenance and loading or unloading holes. Once the machine is positioned, all further operations are controlled remotely. All motions of the machine are displayed on panels in the control room, which also includes television equipment to enable parts in transfer between the machine and reactor to be viewed without hazard.

The machine is designed to change the fuel in three channels in 24 hours. The core contains 2,575 channels, and to achieve the continuous loading programme for which the station was designed, fuel changing will commence soon after the reactor comes into service.

Nuclear fuel arrives at Bradwell by road. Each reactor has a room where it is stored in boxes until required. Elements taken from the store are first inspected and then loaded into a magazine. This magazine has a rotating



Fig. 2. Bradwell's reactors and heat exchangers are now concealed by nearly completed glass and aluminium cladding. On the left is the turbine hall and administration block

turret with capacity for three fuel channels. A loading tube connects the magazine with the pile cap level where the charging machine operates.

When the machine has changed the elements in a group of channels, it moves to the unloading hole. Here the irradiated elements are lowered on to a skip which runs on an underwater carriage. When all the elements have been unloaded the skip is drawn along an underwater duct into the decay pond.

The irradiated fuel elements remain in the decay pond for a period before they are taken by a crane to the coffin bay. The elements are loaded into empty coffins under water and a transporter takes them to the separation plant.

Bradwell nuclear station is being constructed by the Nuclear Power Group—a partnership of the AEI-John Thompson Nuclear Energy Co. and the Nuclear Power Plant Co.

European Equipment Approval

ADOPTION of green/yellow for earth cores of portable appliances was the outstanding decision of CEE* at its autumn meeting in London recently. Although this captured popular headlines, there were many other decisions taken of importance to the free flow of trade in electrical equipment. For example, a proposal was made that a colour code be introduced for identification of conductors in fixed wiring as distinct from flexibles. The UK delegation opposed this, as did representatives of some other countries, on the grounds that it was better to leave such matters to those responsible for wiring regulations in individual countries. However, the counter-argument was advanced that such a code could be applicable to equipment such as machine tools, in which there was international trade. The matter was remitted to a technical committee dealing with cables.

CEE is, of course, only one of the international bodies operating in the electrical standardisation field, and some of the time at the meeting was given to discussion on IEC standards. One of those affected was that dealing with mains-operated radios. IEC are to be asked to include a standard CEE classification for protection against electric shock. In this, Class 1 represents equipment protected by earthing; Class 2 that protected by suitable insulation; and Class 3, equipment operated at extra-low voltage.

Rules of procedure for CEE were discussed at the London meeting and an important British proposal was accepted. This provides for incorporation of provisions that if any member body of CEE finds it is unable to

accept a CEE specification as a national standard, because of difficulties about dimensions, a note to this effect shall be included in the relevant CEE publication.

Technical Committees

Besides plenary meetings, opportunity was taken of the London gathering for meetings of a number of technical committees. Socket-outlets received consideration, and there was provisional agreement on a number of details of types and tests. There was agreement that a new draft for switches for appliances should be circulated for consideration at another meeting to be held next spring.

Draft recommendations for creep distances and clearances came under consideration, with the rejection of a secretariat proposal that test voltage should be used as basis for classification. It was decided that there should be three classes for creep distance and clearance according to whether pollution was negligible, normal or heavy. A table of provisional values within these classifications and for various voltage ranges was agreed.

Lighting fittings have been under consideration by CEE for some while, and further progress towards agreement was made in consideration of a fifth draft of a standard. Detailed British proposals for a test method for heating were agreed, as were the general lines of a test for dust tight enclosures on the lines of an existing German test.

A meeting of the cable committee considered proposals of a working party on standardisation of conductors non-flexible cables. Although these were agreed on the whole, Britain, unlike other countries, said the changes involved were so great that it was not possible to say whether or when the proposed CEE standard could be incorporated in British standards for cables.

* CEE is the International Commission on Rules for the Approval of Electrical Equipment. It endeavours to bring into line safety regulations of individual countries for a wide range of electrical equipment.

D.C. for industry

E.D.A. INDUSTRIAL DEVELOPMENT CONFERENCE

THE principal subject for discussion during the Fourth Industrial Development Conference, organised by the Electrical Development Association at Leam Spa last week, was the provision of industry's d.c. requirements from an a.c. generation and distribution system. Mr A. N. Irens, M.Sc.(ENG.), M.I.E.E., Chairman of the South Western Electricity Board and also of the Industrial Development Committee, presided.

From A.C. to D.C. Conversion

In the opening paper, Mr J. E. Boul, A.C.G.I., M.I.E.E., of the English Electric Co., made the point that there are many cases where d.c. supplies were essential to industrial processes. In other spheres the use of d.c. holds attractions away from providing an operating convenience which cannot be equalled by a.c. though there are categories in which the equal merits of a.c. and d.c. are subject to debate, preference and even, on occasions, to prejudice. Looking, first, at the electric motor. The outstanding characteristic of the d.c. motor is its high starting torque coupled with ease of speed regulation. The speed range of 2 or 3 is readily obtainable by field control and, by varying the applied voltage, maximum torque can be maintained over the whole range. Moreover, the regulation is smooth since small control currents in field systems are used. In addition, the design of the system is simple and reliable. Regeneration and reversing can also be effected. Regulation of the small field currents and the control system is silent in operation.

In contrast, an a.c. motor control gear, inserted in the current conductors, is heavier in construction, inclined to be noisy and may be subject to pivot and bearing wear through vibration. For the single speed drive and where starting torques are not greater than 2 to 3 times full load torque, the a.c. motor is, of course, unrivalled.

Electro-chemical Processes

Electro-chemical processes almost invariably need d.c. high currents and demands. The products range from gases and chemical compounds to metals.

In the production of aluminium from alumina dissolved in molten cryolite at temperatures above the melting point of the metal, the process takes place in electrolytic baths in which the current flowing ranges from 40,000 to 100,000 amps or more at 5 V; it is usual to connect a number of such cells in series so as to utilise a higher overall voltage of anywhere from 500 to 1,000. Typical lines range in size from 100 MW with an annual output of 10,000 to 40,000 tons. In such processes a desirable economic aim is 24 hrs x 365 days a year and such an aim places a high premium on continuity of supply and plant reliability. If supply ceases for more than an hour or so, the metal will solidify, necessitating many weeks of work in melting the cells.

Processes involving aqueous electrolytes are limited by the recommendations to 250 V in order to prevent leakage currents to earth across the cell insulation. Other

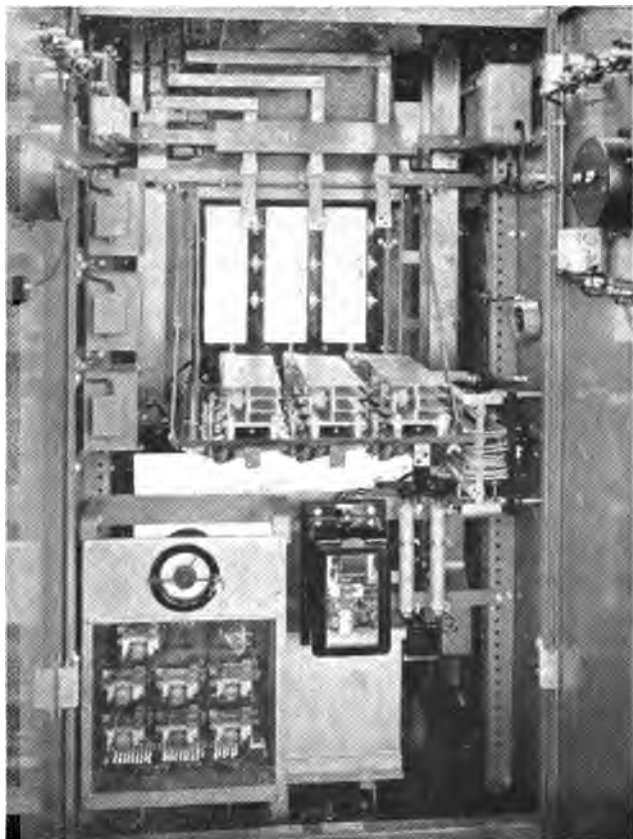


Fig. 1. A 100 kW 60/67 V, 1,500 A silicon rectifier unit for electrolytic duty. The cubicle doors are shown open with the rectifier tray lowered for inspection (GEC)

electrolytic processes include chlorine generation, used as a bleach and also in considerable quantities by the plastics industry, hydrogen, hydrogen peroxide, ammonia, nitric acid, fertilisers, ethylene dichloride, sodium chlorate and caustic potash. An Indian unit for the production of fertiliser was quoted as having a total demand of 176 MW, using mercury arc rectifiers, and with an output of 1,200 tons of fertiliser a day.

Electro-plating, anodising, electro-chemical milling, grinding, deburring, polishing and the forming of battery plates are all indicative of industrial processes requiring substantial, though lower, d.c. power.

Motor Drives

For certain industrial processes d.c. drives are essential. These include rolling mills, paper mills, rubber calenders, mine winders and some cranes. Consider the requirements of a steel rolling mill incorporating a number of separate motor drives. The first process is "cogging," the passing of an ingot to and fro through a succession of reversing rollers at varying speeds. Each pass results in a reduction in cross section of the ingot and an increase in length until the former has been rolled down to the required shape.

and size. The requirements for the drive are high torque at low speed, low torque at high speed, frequent reversal of rotation and rapid acceleration and retarding in either direction to reduce unproductive time.

Though these requirements may be met by a.c. induction motors in the smaller mills, the d.c. motor shows a considerable saving in energy. On the larger units, it may need d.c. motors ranging from 10,000 to 25,000 h.p. running at speeds not more than 100-120 r.p.m. The time for reversing such a mill may be of the order of one second.

In tinplate rolling, the ingot is reduced to thin sheet or strip in a series of "passes," the first of which are carried out hot and the last, when the strip is sufficiently thin, cold. As the strip lengthens, for convenience and economy it is threaded through a succession of rollers, or "stands," in tandem each increasing in speed to prevent the strip buckling or looping between stands. This necessitates close control of each of the roll motor speeds, which may have to be within $\pm 1\%$ of the set speed. Except for the initial roughing stands where the speed requirements are not so stringent, this can only be done with d.c. motors. A typical mill may comprise ten stands, of which the first three are driven by a.c. motors and the remainder by d.c. motors.

In cold strip rolling the tension between stands to stretch the strip is achieved by increasing the speeds of successive motors, again to closely controlled limits. In the last stand it may be passing the strip at as fast as a mile a minute while a much lower speed, say 200-300 ft/min, has to be adopted for threading. Acceleration from the threading to full rolling speed must also be carefully controlled. The required operating speed range of 25:1, high accuracy of speed and load control, rapid response and capability of changing smoothly from motoring to generating (for braking) at a given speed are ideally provided by the d.c. motor.

Inevitably a twilight zone will exist where the technical needs of a drive are not so exacting as to demand d.c. control, and the preferred practice will change, as developments take place which affect the performance, in favour of one or the other.

Railway Traction

Another sphere is that of railway traction, in which the battle of systems has raged for many years and continues to be fought with heat in many circles. There are two problems; that of driving the train and that of supplying the current to the train whilst in motion. The former favours the d.c. series compound motor; the latter favours a.c. transmission enabling higher voltages to be employed on the conductor lines and rails, with preference for the lower cost overhead system.

In the early years of electric traction low frequency a.c. at $16\frac{2}{3}$ c/s were tried, the reduced frequency overcoming, to some extent, the poorer inherent starting torque of the a.c. motor. As the idea of a standard system frequency took hold, with a balance in favour of 50 c/s, the a.c. traction system gave place to d.c. with third rail conductors. Though a satisfactory 50 c/s a.c. traction motor is still beyond attainment, recent developments in static a.c./d.c. conversion have enabled railway systems to use relatively high a.c. for transmission with rectifiers on the train to provide the d.c. for the traction motors. Such systems have been used in several countries, notably Britain, France, India and Russia.

Marine Propulsion

In marine propulsion, requirements differ from those of rail traction. Nevertheless, for tugs and ferries, where the emphasis lies on manoeuvrability and easy control, d.c.

propulsion is usually preferable. For the ocean going li a.c. induction or synchronous motors are at home in providing the link between the steam turbines and the screw propellers.

There is, of course, no alternative to d.c. for the excitation of generators and alternators, for lifting magnetic electrostatic dust precipitators and a variety of electro devices as well as a host of applications which depend upon a battery for their supply in an emergency. D.C. transmission is also a field of some promise in that line loss at exceptionally high voltages over long distances is reduced, but the limitations here lie mainly in the forms of circuit-breaker suitable for controlling fault currents at the initial provision of line reactive load. But these problems may be solved in time. Meanwhile some d.c. lines have been and are being erected in Sweden (70 MW France/Britain cross-channel (160 MW) and Kashin-Moscow, while an 800 kV 700 MW d.c. line is being experimentally developed between Dombas and Moscow to transmit power from Siberia to Western Russia.

D.C./A.C. Converters

Of the many methods of converting a.c. to d.c. most are so well known as to need no description. These include the oxide and polycrystalline (selenium) rectifiers, synchronous commutating devices and vibrating "reed" rectifiers, rotary converters and motor converters. In recent years emphasis has shifted to the use of static rectifiers including mercury-arc, monocrystalline semi-conductor and thermionic types. Though the Ward-Leonard and light sets are still favoured for many fields, there is indication that the former may be largely supplanted by grid controlled mercury-arc rectifiers in the future.

Rectifiers

Rectifiers can be grouped into three broad classes: thermionic, mercury-arc and crystalline. The former, the conventional "valve" of radio and allied techniques, used as a rectifier, with or without grid control, provides d.c. at high voltages but relatively low current. Mercury-arc rectifiers can be divided into glass envelope and steel tank types with the latter again sub-divided into pumped and pumpless. In all three the principle is the same: a mercury pool cathode in an exhausted enclosure with one or more

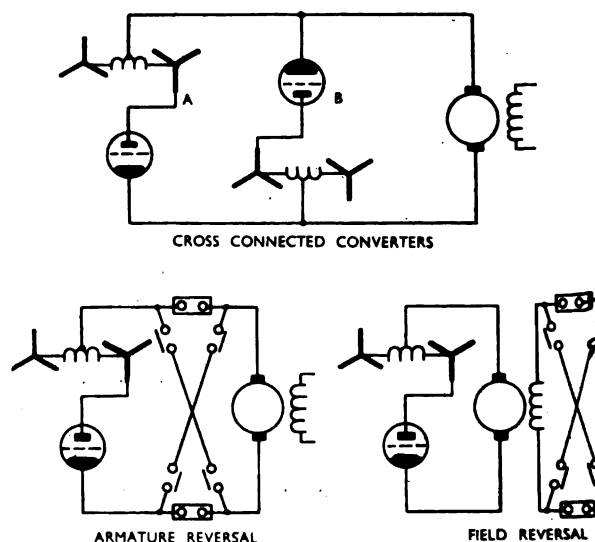
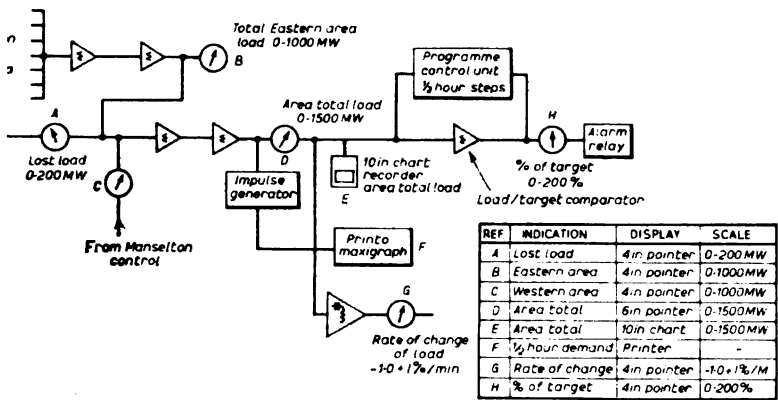


Fig. 2. A schematic presentation of the different methods achieving motor reversal with mercury-arc rectifiers



Schematic diagram of the telemetering system as adopted by the South Wales Electricity Board at Church Village, Pontypridd

and an igniting device. Single-anode devices may be used as excitrons or ignitrons according to the type of excitation incorporated. The ignitron depends on the formation of a hot spot on the surface of the cathode by a current pulse applied to a permanently attached igniter, the tip of which just breaks into the arc of the mercury. The excitron uses an excitation electrode suspended above the mercury, which maintains a continuous arc from a subsidiary source. Both ignitrons and excitrons may incorporate grid control. Multi-anode devices also may incorporate grid control and are used in conjunction with multi-phase a.c. supplies. For industrial applications the metal tank rectifier is preferred and, in most cases, is of the pumpless, air-cooled type.

Semiconductor rectifiers in the crystalline group, mainly silicon and germanium, are monocrystalline and are used for the copper oxide and polycrystalline selenium for most industrial purposes. Of the two semiconductors, silicon is the more suitable for higher temperatures, but the forward voltage drop of silicon is about double that of germanium. In the diode type, both types have established themselves for industrial uses which do not require continuous voltage regulation, particularly in the very heavy current electrolytic industries, where they are on the way to supplant the mercury-arc rectifiers.

Controlled mercury-arc rectifiers have supplanted thyristor drives for motor control in some cases, thyristor being applied as a bias to the grid. It is, however, possible to obtain reverse rotation of the motor by phasing the rectifier grids back to the condition of inversion and other methods have to be adopted. Various ways of meeting the problem are shown in Fig. 1.

Loads and the Supply Boards

For industrial purposes, rectifiers are all of the multi-phase type unless the load is low and the ripple content is not important. The effects of large d.c. rectifier loads on the a.c. system were dealt with in a paper presented by W. G. Thompson, PH.D., B.Sc., M.I.E.E., of the South Wales Electric Co.

Working with the effects of harmonics associated with industrial equipments, he showed that the harmonic content of the a.c. system is inversely related to the number of phases. Single-phase a.c. traction will bring in all the harmonics, but on multi-phase systems, as the number of phases is raised the harmonic content is progressively reduced. To protect against loss of rectifying action due to failure on mercury-arc rectifiers, instantaneous tripping of the a.c. breaker, together with operation of high-speed d.c. breakers, is essential. High-voltage connections in the secondary connections from the trans-

former is another arrangement particularly applicable to the glass envelope types.

Load Control

The control of industrial loads, both d.c. and a.c., was the subject of a paper presented by H. Jackson, B.Sc., M.I.E.E., and R. F. Charles, A.M.I.E.E., both of the South Wales Electricity Board. Though the statutory obligations to maintain supply and voltage within prescribed limits laid down by earlier Electric Lighting Acts were, in effect, suspended in the immediate post-war period when plant was inadequate to meet the demand, this phase is now happily over. Load shedding, except in an extreme emergency, is a thing of the past.

The cost of electricity to the consumer is, however, governed largely by the load factor and voluntary restriction of demand at peak periods by large consumers can be a valuable contribution to lower overall current costs; indeed, a new feature of the bulk supply tariff introduced on 1 April, 1960, provides special terms to those who can offer disconnectable loads of not less than 25 MW to the Board.

Such consumers are, of course, comparatively rare, but in the Pontypridd area of the South Wales Electricity Board the conditions are particularly suitable for central control of load. Describing the new central control system which has been installed at Church Village, the authors pointed out that the prime purpose of erecting the centre was for maintaining continuity of supply but, paradoxically, it has provided a means by which load control can be effected on an area board scale.

Outlining the methods by which the system was operated, it was stated that, during the winter of 1959-60, it was possible to reduce Area Board demand by 60 MW. Much of the disconnected peak loads is recoverable, in terms of industrial production, by planned diversity. In this way a large manufacturer of chemicals, using 3-18 MW submerged arc calcium carbide furnaces, was able to reduce his load from 54 MW to 38 MW for a number of weeks or to 2 MW for short periods, on receipt of instructions from the central control engineer, without serious loss of production. Revised working schedules, ensuring that all heavily loaded plant is not in operation at the same time or is only together at off-peak periods, and the development of off-peak loads is another way of attacking the problem.

Telemetering equipment is a vital contribution to central control and, with a knowledge of the local peaking periods and their significance in terms of individual large consumers, the Area Board control engineers can make a valuable contribution to overall load factors. Initially confined to large consumers, there is no reason why smaller consumers should not be drawn as time passes. Ultimately, central control can be further approached on a national basis by the CEB.

Other papers read before the conference included an interesting dissertation on the principles of heat transfer and the approach to the industrial heating problem by J. T. Sharples, of the EDA; characteristics and applications of the silicon-controlled rectifier by A. H. B. Walker, of Westinghouse Brake and Signal Co.; and the applications of metal-sheathed, mineral-insulated heating elements in industry by N. Kershaw, of the NWEB.

OVERSEAS NEWS



from our correspondents abroad

CANADA °

Quebec Hydro Gains

Although new rates reduced the revenue per kWh of domestic consumption from 1·28 cents to 1·25 cents, a substantial increase in both revenue and sales is disclosed in the recently published annual report of the Quebec Hydro-electric Commission for the year ending 31 Dec., 1959. Over the year, assets rose by 14% to \$1,062,496,769 but the operating costs rose by only about 1% over the previous year to \$40·1 million. The amount available for transfer to reserves was also slightly higher than the previous year at \$24·7 million after taking into consideration \$22·84 million paid as interest on the funded debt.

A rise of 10% in the total electricity sales from 12,400 million kWh to 13,600 million kWh during 1959 included nearly 1,900 million kWh of domestic sales. Domestic sales are now averaging 4,086 kWh per consumer, an increase of nearly 9% on last year. This rise is attributed to a new sliding scale rate of charges.

Priority Power Study

No doubt the recent report published by a delegation of Canadian engineers who visited the USSR has had some influence in prompting the Government to propose a rush, full-scale economic study of Canadian electrical needs for the next 20 to 40 years. The National Resources Minister, Mr Alvin Hamilton, is reported to be bringing together representatives of provincial Governments, power utilities and electrical manufacturers to discuss future developments. He said the Government was giving top priority to greater Canadian electrical power development. A full-scale economic study to assess future power needs and examine power systems growth and power resources would be followed by a physical study of methods of transmission and generation. Political questions to be settled were how such a power grid could be financed and under whose authority it would operate. It seems that a number of Canadian power leaders are not pleased with the Government's proposals. They think that Canada should be moving much faster in power development.

It is clear that the delegation to the USSR was much impressed by developments there and some of their findings were reported in the ELECTRICAL TIMES

for 6 Oct. Leader of the delegation Mr J. S. Duncan, chairman of Ontario Hydro, said that negotiations are under way to send groups of Canadian utilities men to the USSR to obtain more specific information, and the way has been paved for an exchange of specialists between the two countries. Electric power production in the USSR is now double that of Canada and by 1975 the Russians may be producing more power than the US.

AUSTRALIA

330 kV switchgear contract

A contract for ten air-blast circuit-breakers rated 2·4 kA, 330 kV, 15,000 MVA has been awarded to A. Reyrolle by the NSW Electricity Commission. The circuit-breakers will be installed at the Sydney North substation where two 380 kV transmission lines will terminate from the 1,500 MW Vales Point station, now under construction. Reyrolle have also recently received contracts for 132 kV small-oil-volume circuit-breakers and 3·3 kV air-break auxiliary switchgear for Vales Point and also 330 kV transmission line protection on the NSW-Snowy Mountains system's interconnectors. The substation is about 25 miles from the centre of Sydney and 80 miles from Vales Point.

Hydro-electric Supplies Assured

Water levels in the Tasmanian Hydro-electric Commission's Central Highlands storage lakes were recently described by Mr A. W. Knight, the Commissioner, as eminently satisfactory. Following heavy rains earlier this year, levels in Great Lake and Lake Echo are only about 1 ft below normal. This capacity could keep the Commission's turbines generating for a dry spell lasting a year if necessary, and extra industrial demands could also be met if they arose. While the reservoirs were filling during the earlier parts of this year, the effects of flooding in the lower reaches of the catchment area were reduced, but Mr Knight pointed out that, with the storage lakes nearly full, most of the water brought down by prolonged heavy rains in the future would not be retained behind the dams.

Nuclear Contracts Sought

Possibilities of extending uranium contracts with the UK and US and arranging new ones would be investigated by a mission leaving Australia

early next year. This was announced the Premier of S. Australia, Sir T. Playford, during a recent broadcast. The mission would be led by Mr Barnes, the S. Australian Director of Mines, and Mr C. R. S. Colyer, manager of the Electricity Trust. Mr Barnes would examine the possibility of further uranium contracts as contracts are due to expire in 1961. It is Mr Colyer's intention to continue progress made with nuclear power projects overseas.

The Premier also commented on a serious labour shortage in S. Australia. Many professions are seeking overseas immigrants and the Electricity Trust also said to be desperately short of skilled staff.

CHILE

Loan for US Equipment

Authorisation of a \$42 million loan to the Chilena de Electricidad (Chilena), Santiago, has recently been granted by the export-import bank of Washington. The loan will cover expansion and modernisation programmes to be spread over a five-year period at a cost of nearly \$93 million. This includes provision to increase generating capacity by 200 MW, initially by installing two 50 MW turbo-generator boilers and four surface condensers.

The loan also covers the USA. The loan also covers the cost of transmission lines, substations and distribution facilities and is repaid over a period of 20 years. Chilena, which now operates 12 generating stations, is a subsidiary of the American and Foreign Power Company, New York, and has operated in Chile for nearly 40 years. The loan makes possible replacement of old operating equipment, and new plant to meet the steadily rising power demand.

KOREA

Power Plans

In plans for further power development in Korea, it is expected that tenders will shortly be called for a contract for the proposed Kunsan 31 steam power station. The engineering survey for this project was carried out by American consultants Burn, Roe, and a sum of \$9½ million already been allocated from AEC ICA funds for its construction.

use, is seriously short of electric supplies and a number of schemes been prepared to alleviate the . One project intended to help outh west is a 20 MW gas : plant at Sonjong-ni, near Naju, olla Nando Province, for which s were recently received. There a 100 MW steam plant project amchon, near Pusan, and there ans for various other thermal and schemes. Lack of foreign ex-, of course, is the principal le to the initiation of the schemes. this year, the programme was entirely on foreign aid, and it is t that the country will eventually long-term credit. Total installed wing capacity in Korea is about fW, of which 143 MW is hydro-c. Peak output last year was MW, and it is estimated that d will rise to 570 MW in 1962, fW in 1965, and 795 MW in 1969.

UGANDA

ernised Cooking

: traditional native dish, "Matoke," ow be produced in modern style a electric steamer devised by the da Electricity Board. The two-part er has an element in the lower half ed for operation with the compact onsumer's units which were recently luced by the Board. The steamer een introduced under the Board's aign for the widespread electrifica-of small homesteads, and sales are ; undertaken directly by the Board. of the steamer, which has a capacity lb, is not expected to be restricted istricts where Matoke is eaten as equally suitable for use where maize titutes the primary diet.

INDIA

ore Power Transmission . . .

uring the Third Plan, power trans-on schemes valued at Rs32 crores be undertaken by the Mysore State ricty Board. This was recently unced in the State Assembly by the ty Minister for Public Works, Mr noor. The plans include establish- : of 36 substations in the State, h would cover most of the power s in North Karnatak. In reply to er questions, the Deputy Minister the 9 MW Tungabhadra left bank on will supply Raichur, Gulbarga other districts, while power from the avathi project would be available ll parts of the State through a high ge network to be constructed under Third Plan. Also under this Plan, ated outlay on development of the r Gold Field undertakings would bout Rs212 lakhs.

and also in Madras

ne third Five-Year Plan for power ration and transmission in Madras : was also discussed recently in the

legislative assembly. The draft of the Plan also surveyed progress with the second Five-Year Plan.

Hydro Extensions

The third Five-Year Plan envisaged in Rajasthan provides for a considerable increase in power generation with the object of tapping the State's hydro resources to the maximum extent possible. The plan includes provision for a hydro project at Mahi to meet the needs of the Durgapur and Banswara districts, where important mineral deposits have been discovered. Power from the Chambal project will feed the Kotan, Ajmer, Bhilwara and Udaipur divisions. Bnakra will supply the Bikaner division. Two thermal projects are also proposed and it is intended to electrify all villages with a population of 5,000. The plan schemes will cost about Rs48 crores.

LIBERIA

Hydro-electric Proposal

Investigations into the possibility of hydro-electric supplies, although requiring further elucidation, are regarded optimistically by the Liberian Government. However, foreign investment would be required as backing for the projects. Growing power supplies seem likely to depend on increased domestic consumption for some time to come, unless local industry chooses to take its supply publicly rather than operate its own generating stations. A US export-import bank loan of \$7 million has been granted to improve and extend the Monrovia power supply by 5-7 MW. It is reported that the present distribution system is in a very poor condition, except for the new British installed ring main and substations, despite the fact that power demand is increasing all the time. Supplies are at present obtained from the 6.8 MW Krutown station and two smaller stations with an aggregate capacity of 1.12 MW.

PAKISTAN

Revised Hydro Scheme

Complete revision of the Gomal Dam hydro-electric and irrigation project in the Dera Ismail Khan area is reported. The revised project which provides for 112 MW instead of 7.4 MW and irrigation of over 300,000 acres of land instead of 100,000 acres is being studied by WAPDA in consultation with Yugoslavian technicians. Cost of the project is estimated at Rs132 million and it would be completed in two phases. The first phase entails construction of a diversion weir at Murtaza with generators to provide 12.5 MW. This phase will assist in irrigation. The second phase envisages construction of a 400 ft high dam at Adamkok with hydro generators of 78 MW total capacity. Such a dam would regulate the Gomal, Zhob and the Wanatoi Rivers, which in the past

have caused great flood damage in Dera Ismail Khan. Storage capacity of the lake behind the high dam would be 1.7 million acre ft and this would also ensure continuous supplies at Murtaza weir, enabling development of some 300,000 acres of agricultural land.

Kunhar Valley Hydro Project

An interim report on the feasibility of the WAPDA Kunhar Valley hydro-electric project has been prepared by a foreign firm of consultants and is reported to be favourable. In the first stage of the scheme, a 385 ft high dam with a storage capacity of 130,000 acre ft would be constructed at Suki Kinari. A pressure tunnel over five miles long would link the dam with the Potandes 95 MW power plant. The subsequent stage would consist of constructing a diversion dam at Paras and construction of a pressure tunnel. The Paras plant would have two 103 MW generators. In the third stage a 410 ft high dam would be constructed near the village of Naran, impounding 283,000 acre ft. In this stage, two additional units would be added to the Potandes power plant to build up a firm capacity of 207 MW. In the final stage a pressure tunnel would be constructed from the Naran dam to a further dam, upstream at Suki Kinari. This dam would have a capacity of 130,000 acre ft and a power plant of 95 MW. The project is estimated to cost Rs87,00,00,000 and would generate 500 MW. Altogether two storage dams and one diversion dam, three power plants and three power tunnels are involved with transmission facilities.



"Hot line" maintenance is soon to be used extensively by the Trinidad and Tobago Electricity Commission. The operators shown were attending a course on manipulation of the insulated rods used, held at the Central Training School, Arima, North Trinidad. It is hoped that the scheme will improve system reliability in the islands

Personalities *in the industry*

The Minister of Power has reappointed **Mr T. E. Daniel**, M.ENG., M.I.E.E., M.I.MECH.E., as chairman, and **Mr T. Coates**, M.ENG., M.I.E.E., M.I.MECH.E., as deputy chairman of the North Western Electricity Board. Mr Daniel's reappointment is for a period of three years, ending December, 1963, and that of Mr Coates for five years, ending December, 1965. The Minister has also reappointed **Mr G. A. Howe**, M.A., LL.B., A.C.A., as a part-time member of that Board. Mr Daniel became chairman of the North Western Board in 1955 after two years as deputy chairman of that Board. From 1948 to 1953 he was deputy chairman of the North Eastern Electricity Board and, prior to nationalisation of the industry, had been borough electrical engineer at Darlington for 11 years, during which period a new generating station was constructed there. Mr Coates first became deputy chairman of the North Western Board in January, 1956 (succeeding Mr Daniel in that position). Earlier, he had been sub-area liaison officer and manager of the Chester sub-area of the Merseyside and North Wales Board for seven years. Prior to vesting day he had been deputy city electrical engineer at Liverpool for three years.

Mr A. H. Olds has been appointed manager of the St. Ives branch of the South Western Electricity Board in succession to **Mr J. H. Jones**, who has been promoted to manager of the Board's Falmouth branch. Mr Olds joined the Board four years ago as a technical assistant in the Commercial Dept. at group headquarters, being concerned with rural development and tariffs, and was recently acting as group agricultural engineer for Cornwall. Mr Jones had been in charge of the St. Ives branch for ten years, prior to which he was manager of the Reading branch of the Southern Electricity Board.

The University Court of Edinburgh University has appointed to the newly established Chair of Electrical Engineering **Mr W. E. J. Farvis**, B.SC.(ENG.), M.I.E.E., F.R.S.E., senior lecturer in applied electricity and head of the post-graduate school of electronics and radio at the university. The appointment takes effect from 1 Jan., 1961. During his 12 years in the Engineering Dept. at the university, Mr Farvis has evolved a new electrical engineering degree curriculum, founded the post-graduate diploma course in electronics and radio and built

up a research school on various types of gas discharge. Earlier he was a lecturer at the University College, Swansea, for three years, where he had previous teaching experience before joining the Air Ministry Research Establishment in 1940 for work on the redevelopment of new decimetric radar systems. In 1941, Mr Farvis transferred to work on the radio defence of London against German raiders using radio beams. For the remainder of the war he headed a large counter-measures group and immediately before the end of hostilities was attached to Sir Robert Watson-Watt's team investigating German research establishments engaged on radio warfare.

With the opening of a new Croydon depot by AEI Lamp and Lighting Co. Ltd., **Mr A. P. Judd** is appointed area superintendent there to succeed **Mr W. Steer**, who is retiring shortly. Mr Judd joined the Edison Swan Electric Co. in 1951 and is already well known in the Croydon area. He has been a lighting engineer with AEI Lamp and Lighting Co. since the company was formed in 1956.

At a meeting of the Electrical Floor-Warming Association last week, **Mr R. F. Weaire**, M.I.E.E., was re-elected as chairman of the association. Mr Weaire is manager of the Panelec Heating Division of British Insulated Cables Ltd.

Mr J. K. Loughton has been appointed divisional manager of the Telecommunications Division of the Plessey Co. Ltd. He has been with Plessey since early 1958 when he joined the Telecommunications Division as sales engineer. Thereafter he became, successively, sales manager, executive assistant to the general manager, and manager of the Division's advanced development laboratory at West Leigh, Hampshire—from which position he takes up his new appointment. Before joining Plessey, Mr Loughton had a successful career in the Royal Navy. After early training at the Royal Naval College, Dartmouth, in 1937, he later specialised in communica-

tions and radio warfare. He was promoted to the rank of commander in 1954. His career in the Navy culminated in 1957 when he was assistant director of Radio Equipment (Communications) at the Admiralty.

Mr S. W. Graefe has been elected chairman of the Midlands branch of the Electrical Trades' Commercial Travellers' Association, with **Mr G. W. Arnold** as vice-chairman.

Newly appointed chairman of the New Brunswick Electric Power Commission is the **Hon Donald C. Harper**, and the new vice-chairman is **Mr H. G. Atkinson**, who has held executive positions with several industrial concerns, including the Abitibi Power and Paper Co.

Mr J. L. Pearce has been appointed district commercial engineer in South District of No. 1 sub-area of the North Western Electricity Board. (*ESH, page 157.) That district embraces Cheadle, Cheadle Hulme, Wythenshawe, Northenden and Didsbury. Mr Pearce was previously with the Board in West Lakeland, leaving in 1957 to become first assistant district commercial engineer in the Consett district of the North Eastern Electricity Board.

Mr H. I. S. Catherwood, M.A., joined Sigmund Pumps Ltd. as sales director on 1 Nov. He succeeds **Mr H. P. Lord**, who has been appointed managing director of International Boilers and Radiators, a sister company in the Booker group. Mr Lord will continue to be a director of Sigmund Pumps Ltd.

A former director of Bowler and Sidney Ltd., **Mr D. L. Sidney** has been appointed home sales manager of the Electrical Division of Auto Diesels Ltd., in succession to **Mr E. Ward**, who has joined Astley Industrial Trust Ltd.

After 38 years' service with the General Electric Co.'s Publicity Department, **Mr "Bill" Bailey** has retired. To mark the occasion he was presented with golf clubs and an electric blanket by his many friends in the GEC.



Mr T. E. Daniel



Mr T. Coates



Mr A. P. Judd



Mr J. K. Loughton



Mr J. Ireland



Mr J. Cooper



Mr A. Hession



Mr G. Casson



Mr P. C. Phillips

British Driver-Harris Co. Ltd. since four new appointments which have been made at their main plant at Cheadle Heath. Mr John Ireland becomes district manager of the Cheadle Heath

Mr John Cooper is appointed district manager, with two newly appointed district works managers—Mr Arthur Brown (wire) and Mr George Casson. All four men have been with the company for many years and are widely experienced in the practical problems involved in the production of electrical appliance materials.

J. E. Wall has been appointed managing director of Electric and Musical Industries Ltd. He recently joined the board of Morphy-Richards following the company's acquisition by EMI.

Manager of the Leeds branch of the National Electric Co. Ltd. since 1950, J. Smith is retiring at the end of this year after 41 years of service with the company. He started as an assistant district engineer after gaining experience at the Keighley Electricity Dept.

Formerly signal engineer to the Scot-Region of British Railways, Mr M. Knotts has joined Mullard Ltd. to act as the company's technical expert on the application of electronics to railway signalling and communication systems.

Previously commercial manager of the Western Division of the Plessey Co. Mr W. N. Richardson has this week joined Hughes International (UK) Ltd. as marketing manager. Earlier, he was district sales manager of Salford Electrical Instruments Ltd. With his headquarters at Hounslow, Mr Richardson's sales staff will be concerned primarily with the semiconductor ranges of the Aircraft Co. Activities will be extended to cover other commercial products, including parametric amplifiers, and various types of c.r.o.'s and associated equipment.

Not Lamps and Lighting Ltd. since the following reorganisation of field sales force: Field sales manager for P. G. Leven; the northern area manager is Mr S. Shaverin, covering Lancashire, Northumberland, Durham; the southern area manager is Mr R. F. Marlborough, covering N.W./W. London, Herts, Bucks, Oxfordshire and Berks. Representatives are: Mr F. A. Flemming, covering West Scotland, Cumberland

and Westmorland; Mr R. Henderson, covering East Scotland; Mr R. Ragione, covering Lancs, Cheshire and N. Wales; Mr J. A. Spillane, covering Midlands; Mr S. G. Aldous, covering Derbys, Leics, Lincs, Norfolk; Mr S. Baars, covering N. and E. London, Essex, Suffolk, Cambs; Mr A. P. Ubank, covering S. W. England and S. Wales; and Mr. C. K. Heffernan, covering S. London, Hants, Surrey, Sussex, Kent. Agent for Northern Ireland is Mr G. M. Gardner, of Campbell Gardner and Co. Ltd.

The new chief engineer of the Yorkshire Electricity Board is to be Mr P. C. Phillips, B.Sc.(ENG.), M.I.E.E. He will succeed Mr J. D. Nicholson on 1 Jan., 1961 (*E.S.H., page 141). The board state that the unsuccessful applicant in the final consideration was Mr A. G. Milne, M.I.E.E., A.M.I.MECH.E., A.M.B.I.M., district manager at Bristol to the South Western Electricity Board. Mr Phillips has been deputy chief engineer of the Y.E.B. since October, 1956. From 1948 he had been with the Merseyside and North Wales Electricity Board, initially as assistant chief engineer (planning) and, from 1955, assistant chief engineer (operations). Prior to vesting day he was with the Edinburgh Corporation undertaking as senior assistant distribution engineer.

Elected president of the Women's Engineering Society is Mrs I. H. Hardwick, M.A., A.M.I.E.E., A.INST.P., of the Research Department of Associated Electrical Industries (Manchester) Ltd., at Trafford Park. After graduating in Physics at Cambridge, Mrs Hardwick joined Metropolitan-Vickers in 1941, and following two years' electrical engineering apprenticeship became a member of the Electron Microscopy Section of the Research Department. Later she moved to the Physics Section, where she worked on Geiger counters, X-ray equipment and the development of X-ray diffractometers. She is now a member of the Physical Metallurgy Section, and in May of this year also took over the duties of Supervisor of Women in the Research Department. Mrs Hardwick is a founder member of the Society's Manchester branch, in which she has held all executive positions, and has been a member of the National Council of the Society since 1946. She became a vice-president in 1956, and for the period 1952 to 1956 was editor of *The Woman Engineer*.

Mr C. H. Crowlie, a director of Hoover (Washing Machines) Ltd., has retired from Hoover on completion of 40 years' service with the company.

Mr H. D. Binyon, group products sales director, and Mr D. J. Hendry, export manager, International Division of the Solartron Electronic Group, are now on a business tour of the Far East, being due to return on 1 Dec.

OBITUARY

Mr J. Billcliff, A.M.I.E.E., organisation research officer of the East Midlands Electricity Board, died on 22 Oct., aged 51. Born at Barnsley and educated at Preston Technical College, he served with the Corporation undertakings of Eastbourne and Cheltenham and, in 1947, was appointed deputy engineer and manager at Nuneaton. He became manager of the Nuneaton District of the Board in 1948, relinquishing that appointment in 1959 to become organisation and research officer at headquarters.

Mr H. A. Lamb, M.I.E.E., general manager and director of Aberdare Cables Ltd., died on 13 Oct., aged 53. After war service as a staff captain with REME he joined South Wales Switchgear Ltd. as chief technical engineer. In 1951 he was appointed general manager of the associated company, Aberdare Cables Ltd., and later became a member of the board of directors.

Sir Cecil Weir, K.C.M.G., K.B.E., M.C., who died on 30 Oct. aged 70, had served on many Government bodies in addition to his immense activity in commerce and industry. Just over two years ago he was chairman of the committee which reported adversely on proposals for co-operation between gas and electricity boards. In recent years he had been chairman of the British Tabulating Machine Co., on the boards of the Pyrene Co., British Enka Ltd., and a part-time member of the British Transport Commission. Earlier, he was for two years chairman of the Dollar Exports Council.

Mr C. F. Jackson, J.P., a director of Lancashire Dynamo and Crypto Ltd. and general manager of its Willesden factory, has died aged 56. He joined Crypton Equipment in 1936 and Lancashire Dynamo and Crypto in 1941.

* Denotes revision to the "Electricity Supply Handbook, 1960."

Lighting fittings in production

ATLAS EXPAND FACTORY SPACE AT SPENNYMOOR

ONE-AND-A-HALF million 5 ft fluorescent lighting fittings a year! That is a very rough estimate of the equivalent output of lighting fittings of all sizes from the three Atlas factories at Spennymoor at the present time. Put another way, if a week's output were to be laid end to end it would stretch for some 30 miles.

It is less than ten years since the company of Thorn Electrical Industries first opened their factory at Spennymoor with a staff of 200, including a nucleus of trained personnel from the company's Enfield factory. The site, an ex-war ordnance factory, was a depressing collection of single-floor huts and buildings to the economical standard of all such places erected in wartime, surrounded by semi-derelict buildings, worked-out collieries and mineral workings and bearing the hopeless atmosphere from the mid-'30s depression.

Most of the buildings were taken over as they were by the incoming companies and converted, at the minimum expense, to their new purposes. Within the last few years the older buildings have been replaced by newer ones, of which the latest, "T" shop, sited close to the entrance to the factory estate, not only introduces some elements of external brightness but, internally, is laid out on an open and airy scale which delights those who are fortunate enough to work there. Moreover, there is room for expanding the buildings in two directions as production demands require.

The new building is the third on the site to produce fluorescent lighting fittings and control gear for the Thorn group and today, together with the adjacent buildings producing "Tricity" cookers and radio receivers, there are well over 3,500 local inhabitants employed, a most

welcome state of affairs in an area which has known long periods of unemployment and despair.

The Control Gear Factory

The necessity for the new premises was largely due to the exceptional demand for the Atlas super-slim "Popular Pack" fittings last year and the introduction of 8 ft 125 W fittings into the standard range. A new design of slim control gear is a vital factor in the super-slim fittings and "T" factory is laid down mainly for the production of the control gear and its assembly into the fittings ready for packing and dispatch. Only the starter switches and fluorescent tubes are manufactured at the Enfield plant.

The layout of the factory is on the production line basis, there being two main flows with overhead conveyor systems. The first draws the basic laminations and allied parts from the stores and passes them down the lines, where they are met by the already-wound coils, assembled, gaps adjusted against c.r.t. presentations, sealed in position with bonding cement, the wire ends "fished" out, insulated and connected to the terminal blocks and housed, together with the condensers, in metal cases. The conveyor line then takes the assemblies to the impregnation plant.

After impregnation—there are three forms, varnish, "Permaset" and compound—the ballast units then travel by the second conveyor to benches for further test, inspection, marking and sealing. They are then ready for transmission to stores or to the assembly benches for incorporation in the fittings. Compound-filled ballasts are now falling out of production, being largely replaced by the resin-impregnated types. For high ambient tempera-



General view of the new fluorescent lighting production lines laid down for the super-slim "Popular" and 8 ft fittings at Spennymoor



An example of automatic assembly in the Atlas plant. In this jig straps are positioned and spot-welded at eight points to the back of the batten spine. Average time for process, 15 seconds

Production

In the last five years the production of fluorescent lighting fittings and control gear has increased by between 300% and 400% and it is confidently claimed that present figures will be doubled in the next two years. Already, plans for further factory extensions are in hand and building will commence during the coming year.

It is claimed that the present factory is not only the most up to date in Britain but also the largest; in fact, it might well qualify as the largest in the world for, though bigger output has been achieved by American companies, on account of the long distances there, it is more usual to break production into smaller units widely dispersed.

The factories are producing not only for the Atlas Lighting section of the group but also for the Smart and Brown and Ekco-Ensign companies. A considerable proportion of the output is exported, where lighting fittings of all three companies are in demand.

The old "Popular Pack," first introduced in 1955, was one of the first high-class fittings to be marketed at an economic price complete with tube ready for installation. The million mark in sales was passed in under four years but the super-slim successor is confidently anticipated to pass the same total in less than half the time, and production has been programmed accordingly.

During the Press visit to the works, the route led through the shops where "Tricity" cookers were in production. Here, there was the same almost frantically energetic effort to keep up with demand for both the Viscount and Marquis models.

All the products of the Thorn factories at Spennymoor are transported to the distribution centres throughout the country mainly by road. This ensures that a fitting urgently required can be available anywhere in Britain for installation within 24 hours of manufacture.

tures, "Permaset" compound—a Thorn development, incorporating epoxy-resin and sand, with a high thermal conductivity—is recommended. The resin being thermosetting, it will not subsequently melt or spill.

The Lighting Fittings

In the press shop a large number of press brakes are constantly producing the metal sections in the right length for the spines, ready pierced for lampholders, starter switches and fixing screws. Bridging straps and end-plates are rapidly attached and spot-welded into position on combined jiggling and welding units which make the welds simultaneously. The average time for a complete welding operation is of the order of 15 seconds.

The finished sections are then degreased, phosphated and electrostatically sprayed—except for the 8 ft units and specials which are, for the time being, hand sprayed—on conveyor lines, emerging from the drying booths in a steady stream under the skilful gaze of inspectors before transmission to the assembly benches.

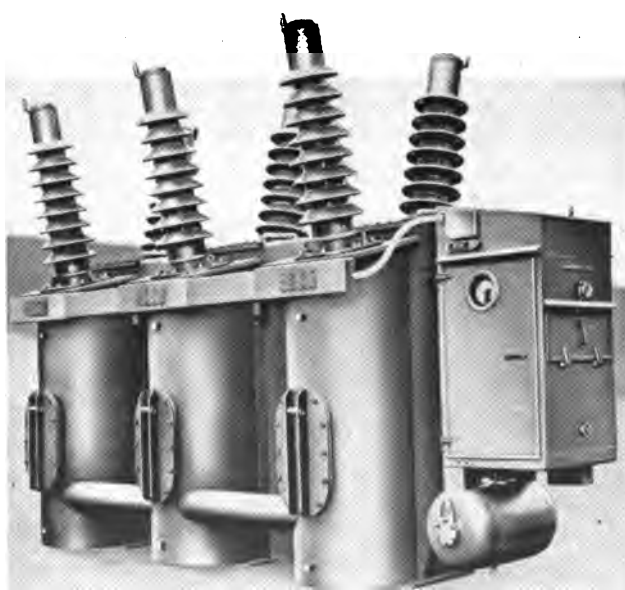
The wiring looms are, meanwhile, being assembled on peg-boards, taped, cut and trimmed at an astonishing speed ready for insertion in the fitting, together with the ballast units, lampholders and starter holders. After inter-connection, the completed fitting is passed to a test bench where fluorescent tubes in racks are connected by wander-leads to the lampholders, the unit switched on and performance checked. A final inspection and packing completes the operation.

The lampholders and starter-switch bases are also moulded on the premises. In the moulding shop British and American thermosetting moulding presses of the automatic type produce them continuously, in phenolic and alkyd compositions, without supervision other than seeing that the hoppers are full and that the finished mouldings are carted away.

Throughout the process quality control techniques are continuously applied and the latest and most efficient machines from Britain or America are used wherever they can assist in improving or accelerating production. The coil winding machines, of the multi-winding type manufactured in both countries, compete side by side, drawing their wire from 100 lb spools, six or eight of which are required to service each machine.

Over 100 tons of copper and iron and 10,000 miles of enamelled wire are used every week for choke manufacture alone. Fluorescent fittings production accounts for 4,000 tons of steel sheet a year. To ensure that the chokes and quickstart units are not noisy, samples are taken at regular intervals from production and checked in a silent room. All of the units, of course, comply with British Standards and are entitled to bear the kite mark, the first of British-made control gear to be accorded this distinction.

NEW CIRCUIT-BREAKER



This recent addition to the AEI Switchgear Division range is a 132 kV breaker, 2,500 MVA, built in three-tank monobloc form to give easy shipping. The design has 60% less oil content than a conventional 132 kV o.c.b.

equipment for industry

Semiconductor range

FURTHER additions to a wide range of semiconductor devices are announced by Texas Instruments. These include a series of silicon controlled rectifiers for power switching 1 A at up to 400 V, maximum gate current required being 20 mA; they supplement an existing range having a rectified current rating of 3 A. Also included are high voltage silicon rectifiers carrying 250 mA at up to 6,500 V. Among devices for computer applications is what is claimed to be the first commercially available gallium-arsenide tunnel diode together with germanium and silicon "mesa" transistors for high-speed switching operations up to 50 Mc/s. In addition, a silicon light sensor is available having a response time of 4μ sec suitable for punched card scanning. As well as an existing range of general purpose n-p-n silicon transistors, complementary p-n-p silicon alloy type can now be supplied operating at -55°C to 150°C . *Texas Instruments Ltd., Dallas Rd, Bedford.*

Demonstrating electromagnetics

TO assist science teachers in demonstrating fundamental electromagnetic phenomena a series of model units have been devised. These consist of various permanent magnet assemblies, tapped multi-turn coils and other auxiliary apparatus. Using the assemblies singly or in conjunction, a number of experiments can be performed illustrating, for instance, the principle of induction, eddy currents and Fleming's left-hand rule. Slotted bases can be supplied for mounting the equipment. Moving-coil appara-

tus is also available by means of which working principles of the motor, dynamo and electrical instruments can be demonstrated. Another item is a torsion balance assembly for measurement of force on a conductor in a magnetic field. Transparent plastics are used in construction of the equipment, making visible all moving parts and connections, the latter being clearly marked. *Griffin and George Ltd., Ealing Rd, Alperton, Wembley, Middx.*

Industrial radiant heater

A RECENTLY introduced industrial radiant heater has dimensions of 24 in. by $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in. and is suspended by means of slotted brackets which permit adjustment to four angles of inclination. Fabricated in specially coated sheet steel, it has a nickel-plated mirror-finish reflector with 10 s.w.g. guard wires. Elements available are 500 W, 750 W and 1,000 W, black heat, and 350 W, 500 W and 750 W, silica sheathed for either 200/220 V or 230/240 V. List price is 63s. *British Central Electrical Co. Ltd., Briticent Hse, 6 and 8 Rosebery Ave, E.C.1.*

Electrical combination lock

DEVELOPED in the USA, an electrically operated combination lock consists of a dial unit incorporating multiple contacts which can be operated in a pre-set sequence to control an electromagnetic locking circuit. As many as four such circuits can be controlled by dialling four combinations, thus one dial unit can be used to lock or unlock four drawers of a cabinet individually.

Combinations can be easily altered if necessary and, as an additional precaution, the unit can be unplugged from the circuits, acting in effect as a master key. Besides having obvious advantages over its mechanical counterpart, there is scope for its application in safeguarding electrical or other equipment from unauthorised operation. *Code Designs Ltd., Oldfield La, Greenford, Middx.*

Welding equipment price reduction

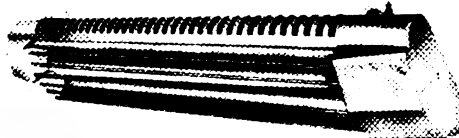
A PRICE reduction of 10% is announced by Lancashire Dynamo for their series CRW.1 resistance welding control equipment. This covers a range of 42 different types, each housed in a standard cubicle assembly and catering for synchronous spot, seam and pulsation welding. The same company have released details of a further addition to their F.43 "Electromagnetic" counter range. This has first wheel digits 0-11 and counts multiples of 12. Two versions are available having maximum counting speeds of 1,500 and 2,400/min, respectively. The new models retain all features of the original series, including plug-in construction and re-set facilities. *Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs.*

Solenoid-operated valve range

A RANGE of solenoid-operated valves new to this country cater for control of compressed air, non-corrosive gases, low-pressure steam and hydraulic fluids. Single, three- and four-way types are available having valve bodies of brass, stainless steel or plastics. Standard models operate on the held-open principle, reverse operation types being also available which will close against fluid pressures of up to 1,200 p.s.i. There are also impulse-operated types, independent of mains supply, and some designed for repetitive operation up to a frequency of 800/min. Coils are continuously rated for a.c. or d.c. at voltages specified to order.

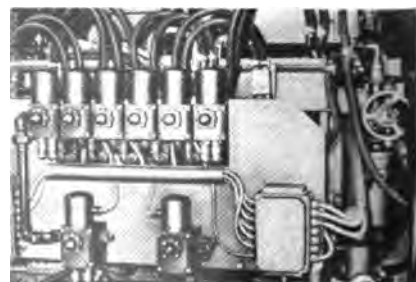
Concurrently available is a range of pressure sensitive switches suitable for incorporation in pneumatic or hydraulic control systems and operation of alarm signals. The pressure-sensitive element operates a snap-action single-pole change-over switch, having various ratings, a typical one being 5 A at 250 V. Maximum operating pressure for the range is about 5,000 p.s.i., while a special model is available for low pressures in the region of the equivalent of 3.5 in. of water. *Londex Ltd., Anerley Wks, 207 Anerley Rd, S.E.20.*

Industrial radiant heater by British Central Electrical can be used for black heat elements, rated up to 1 kW, or silica sheathed elements up to 750 W



These pupils are being shown an experiment constructed from a series of components made specially by Griffin and George for science teaching

A group of "Londex" solenoid-operated valves controlling air flow. Similar valves can be used for controlling non-corrosive gases, l.p. steam and certain fluids



for the electrical trade

"Packaway" 'fridges

Basic styling of Prestcold's "Packaway" refrigerator has been their whole 1961 range, it is 1. The result is that three now incorporate the principles "Packaway" the Design of the rd and the Duke of Edinburgh for elegant design; they ec," "Five" and "Eight." The original model, built for ss and harmony with other aits, but it incorporates some modifications. It now has res instead of four and a tilting covers one of the door racks. compartment shutter is black. al catch has been dispensed the door now seals magnetise features, and the original ave been applied to models rd "Eight," both of which de interior lighting and wheel. The larger model has level ts and a braking device, eight s, five shelves, including the crisper tray, and a full-width The smaller models can be with coloured worktops as extras. Prices and capacities are :

.....	3-1 cu ft	£52 10s
.....	5-2 cu ft	£69 6s
.....	8-1 cu ft	£93 9s

mounted version of "Three" is 1 9s. Prestcold Division of eel Co., Cowley.

ew "Infraphil"

ETE redesigning of the well-n "Infraphil" medical infra-has resulted in a totally nit which is to be marketed as



a new model retaining the original name. Though its general appearance has been altered, the highlight of the new model is its moulded lens—a glass pressing in a series of concentric prismatic sections. Infra-red rays are concentrated into a beam 4 in. in diameter at 10 in. distance. New methods of forming are said to have improved the reflector and lens as a combined optical unit, whilst the filament is more accurately placed in relation to them. Rating is 150 W, and life 300 hours approximately. Price £4 17s 6d. Philips Electrical, Century Hse, Shaftesbury Ave, W.C.2.

Mercury fluorescent price cuts

SUBSTANTIAL reductions in prices of mercury fluorescent lamps are announced by two manufacturers, Philips and Stella. MBF/U 250 W colour-corrected lamps are now priced £4 4s—a drop of 15s—while the larger internal reflector types, MBFR/U 250 W colour-corrected lamps, are reduced by £1 to sell at £5. These alterations were effective from 1 Nov. Philips Electrical, Lamp and Lighting Group, Century Hse, Shaftesbury Ave, W.C.2; Stella Lamp Co., 158-160 Shaftesbury Ave, W.C.2.

Canadian-style kitchen luxury

A SELECTION of kitchen appliances from Canada is about to be launched into the luxury market here. Units under the trade name "McClary-Easy" will include washing machines, clothes dryers and air conditioners, whilst four cookers and four refrigerators are available at once.

The cookers incorporate most labour-saving devices known to us, and some others not so familiar. There is no mistaking the transatlantic designing of these units, with their broad fronts, widely spaced hotplates and impressive panel of controls. The ovens incorporate rotisseries and fulfil the functions of an ordinary grill. There is no splashplate, a raised rear panel bears the switches. Finer points are an extra socket-outlet for lesser appliances, such as mixers, and "meat-minder" probes which are pushed into joints during roasting to operate a pre-set cutout when the desired interior temperature has been reached. More familiar features are: automatic timing, glass oven doors, interior light-

ing and warming drawers. Prices range from £123 18s, tax paid, to £142 16s.

The refrigerators are: two 10 cu ft models, one 11 cu ft model and one 13 cu ft model. The smaller cabinets are noteworthy in that they are slim for all their large capacity, requiring little more than 4 sq ft of floor space. They feature very large freezers and automatic defrosting. Door shelves and drawers in blue, and aluminium freezer doors are in keeping with the smart exteriors. An unfamiliar feature of all models is the chrome trimming around the doors—this and the unusual design of handles stamp these smart cabinets with a final touch of luxury. Prices range from £121 16s to £172 4s, including purchase tax, and £3 3s service fee. General Steel Wares, 259 Marylebone Rd, N.W.1.

"Thermalay" range grows

THE popular "Thermalay" range of electrically heated carpet underfelts now includes three further sizes. They measure 3½ yd by 2½ yd, 4 yd by 2½ yd and 5 yd by 2½ yd, and their introduction brings the total number of sizes available up to ten. Odd lengths of underfelt in widths up to 108 in. can be obtained from stock to fill in odd spaces. Thermalay Ltd., Shelf, near Halifax.

Convactor with a difference

A FLOOR-STANDING convactor heater to be introduced this month can be transformed into a clothes dryer, complete with racks, in a few moments. Basically it is of familiar upright design, a shallow cabinet standing about 30 in. high with an opening at the bottom and a louvred outlet at the top front face. The front panel, however, pulls downward to lie horizontal to the ground and in this position the usual air diffuser is revealed—a rectangle of expanded metal concealing the element. Racks are unfolded and supports engaged over the heating unit and the transformation is complete in three movements. The new convactor-heater and dryer is called "Straightaway"; its rating totals 2 kW with two-heat control and pilot light. Castors are fitted and it sells at £13 17s 6d, tax paid. Barber Electrical Services, The Airport, Weston-super-Mare, Somerset.



"Packaway Eight." Biggest of Prestcold's 1961 range. Price £93 9s.

"Straightaway," a compact heater that becomes a dryer at a moment's notice

The changing lamp shape

FOLLOWING the trend toward "mushroom" shaping of domestic lamps, Crompton Parkinson have announced the "Newshape" model in wattages up to 150. Prices are as follows:

40 and 60 W ...	1s 8½d
100 W ...	1s 11½d
150 W ...	2s 10d

These figures include purchase tax. Crompton Parkinson, Crompton Hse, Aldwych, W.C.2.

Cantilever tube fitting

AN elegantly designed domestic fluorescent ceiling fitting, "Netaline Luminaire," is to be marketed in the north west. An excellent example of simple yet decorative styling, it is suspended by a single cantilevered arm. The cover, where the arm meets the end of the tube, is slim and smoothly modelled and the cap at the farther end unobtrusive, thus the fitting owes its decorative appearance purely to the angle of arm and tube. It is easily installed with fixing accessories supplied and employs a 40 W 4 ft warm-white tube. Available in pastel shades of blue, yellow and lilac, this fitting is obtainable at present in Cumberland, Westmorland, Lancashire, Cheshire and parts of North Wales. Price £3 19s 9d, including purchase tax. AEI Lamp and Lighting Co., Melton Rd, Leicester.

New infra-red wall heater

A 1 kW infra-red heater for £5 3s 6d is the latest appliance introduced by Grubbs. The new heater, "Barry," a wall mounting model with cord switch, has a finish of hammered gold and silver with cream end-plate. Length is 2 ft. Grubb Engineering Co., Mary St, Birmingham 12.

Plate-warmer for the table

AN interesting application has been found for the "Mhoglass" mesh-type element in the Morheat Hotplate, a plate-warming unit for the table. It comprises a heated panel of "Mhoglass" non-metallic element sandwiched between two boards of Swedish Masonite, supported on tubular legs of white plastics-covered metal. The supports also incorporate handles at each end of the board—an economic design with a pleasing contemporary touch. The board is finished in silver-grey stove enamel. The hotplate measures 28 in. by 8 in., has a rating of 125 W, and sells at £5 5s tax paid. Morheat Ltd., Church Path, Fareham, Hampshire.



"Netaline Luminaire," the novel cantilevered fitting by AEI. Price: £3 19s 9d

TRADE PUBLICATIONS

EKCO.—Large coloured wall-chart providing rapid guide to domestic and industrial heating units. Ekco Heating, E. K. Cole Ltd., 5 Vigo St, W.1.

STRAND.—"Lighting for Entertainment." 32-page coloured catalogue of stage and studio lighting equipment and accessories. The Strand Electric and Engineering Co., 29 King St, W.C.2.

G.E.C.—New edition of "Living Electrically With G.E.C." 39-page coloured catalogue and price-list of appliances. Also full colour folder describing the new Treasure cooker. G.E.C., Magnet Hse, Kingsway, W.C.2.

WIGGINS.—Technical leaflet on bitumen compounds in reactor shielding. Berry Wiggins and Co., Field Hse, Brems Bldgs, Fetter La, E.C.4.

T.C.C.—Technical Bulletin No. 9: "Flexi-strip" flat-form multi-way cable; No. 68: Miniature tubular electrolytic condensers; No. 70: Sub-miniature tubular electrolytic condensers; and No. 72: Miniature tropical paper condensers, low voltage "Metalmite" range. The Telegraph Condenser Co., Radio Division, North Acton, W.3.

FERRANTI.—54 new data sheets for Technical Handbook, Vol. 1—Valves and Cathode Ray Tubes, with instructions for insertion of sheets and removal of 22 superseded or obsolete sheets. Ferranti, Electronics Dept., Gem Mill, Chadderton, Oldham, Lancs.

GRIFFIN.—Eight-page pocket book lining principles and uses of electric t entitled "What Good is Warmth? Worry About It?" David Griffin Ltd factor of "Dee Gee" blanket), rietta St, W.C.2.

A.A.—Circular announcing anodis cesses by Alumilite and Alzak Ltd Wks, Station Rd, London S.W.19.

MARTINDALE.—Two leaflets: "Pul and flywheel bearing pullers" and wedges" with price lists. Martindale Co., Westmorland Rd, N.W.9.

VOLEX.—14-page booklet, "The G Heating Cable," describing system it-yourself" soil warming. Volex Products, Salford 6.

MOPUMP.—Ten-page brochure c feed pumps in the SC range. Brydon and Youatt, Reddish En Wks, Stockport.

STC.—116-page illustrated brochure, "STC Products for Wo ways," Standard Telephones and Connaught Hse, 63 Aldwych, W.C.2.

INTERNATIONAL RECTIFIER.—Bull 2006 on range of selenium recti price list. International Rectifier Green, Oxted, Surrey.

BALZERS.—Pamphlet listing vacuu ing systems in German, French, En Italian. Balzers High Vacuum, 1 Me Terr, Regent's Park, N.W.1.

Nine-line Start for Bridges

THE entry of S. N. Bridges, manufac- turers of electric home tools, into the appliance field is marked by nine attractively designed yet moderately priced products. There are three table-cooking units, three electric blankets, a fan heater, food mixer and hair dryer in this range, which is known as "Luxury Life."

The most expensive item is the fan heater, a three-heat model with a top output of 2½ kW and two fan speeds. It is of conventional floor-standing design, but boasts the unusual feature of square push-button controls. These are placed neatly under the handle on the top of the casing. Two neon lights, one above and one below the grille, indicate when the heater is wired and connected properly and when it is actually in operation. The usual cut-out device is incorporated. The new fan, available in gold/black, red/black or two shades of grey, sells at £10 17s 6d, tax paid.

The food mixer is a hand-held model with a single paddle inserted directly into the short cylindrical casing. Its

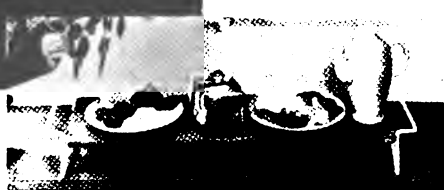
attachments are a whisk, a b three-bladed mincer and a coffee-attachment. Price £8 19s 6d c

A range of three electric comprises a single bed 92 W ve satin with neon-lit bedside co measures 60 in. by 30 in. and i £5 5s. Its double-bed counter £7 15s, has a 120 W loading. Th model has independent control two halves. Loading of 95 W trolled by a five-position switch. as "Royal Rest" it is priced £9

Highlight of the cooking rar griddle hot-plate for table u 1,500 W rating. It measures 18 11½ in. and stands on four sm Price £9 9s. Two other table a are a skillet and a cooker/b £6 19s and £8 1s 6d, respectiv 11 in. diameter skillet has a lo 1,200 W and sells complete wi glass lid which acts as a servi The 1,350 W cooker/boiler de roasts, boils and bakes. Like i panion model, its glass lid doub serving dish. A frying basket is in the purchase price. Each of t cookers above is to be used "Selectrol" thermostat connecto

A pleasing feature of the ha is the way in which it is desi stand upright or hang on the well as rest comfortably in th hand. It eliminates the expens extra standing support, which t required by some previous mak model is available in pink, m white. Rating 400 W, with a resetting safety cut-out. Price ££ tax paid. S. N. Bridges and C Rd, Battersea, S.W.11.

Morheat's smart hot-plate for the table. £5 5s



Generation survey

I.E.E. CHAIRMAN OUTLINES FUTURE TRENDS

UEL cells, thermo-electric and thermionic generators and MHD generators were under consideration as more direct and simpler means of converting fuel electrical energy, said Mr A. C. Thirtle, M.I.E.E., in his address to the IEE Western centre. (Mr Thirtle is director of Southern, S. Western and S. Wales CEBB region.) He was surveying developments in the supply industry over the last 40 years and indicating possible future trends in generation.

Electricity generation since 1920 had risen 26-fold and peak demand had risen 18-fold. In the same period, number of units obtained from one ton of coal had risen from 585 to 1,742 and sales of electricity per man employed in the supply industry had quadrupled.

He referred to the substantial reduction in transmission losses which had taken place and which was most marked in the reduction from 15.9% to 11.1% in distribution losses during the first ten years after the grid came into operation. Even so, he considered the present level of units lost in distribution too high and that such a situation showed a need for capital expenditure on distribution improvement.

Grid Growth

The CEBB's future projects were based on a critical assessment of demand increase, estimated by the area for a forward period of seven years at each of the bulk supply points. Present plans provided for an increase in generating capacity by 1965 of 37,500 MW, 55% over the five-year period; 55% of this generation would be in ten new stations, seven of which would be sited at the coalfields and three near London. Extension to existing stations and commissioning of the six new stations would each contribute a further 21%, the remaining 3% would come from the Rheidol and Ffestiniog pumped storage schemes.

Advantages of larger sets were clearly indicated by the following comparisons. A 180 MW station with six 30 MW sets required a building volume of 39.4 cu ft per kW. In a 1,100 MW station with two 550 MW sets the figure fell to only 22.1 cu ft per kW. Generator weight for a 550 MW set was less than 40% of that for a 30 MW set of the same rating. Despite a 70% rise in material and labour costs over the past 12 years, station capital cost had fallen to £50 per kW and for the Thorpe Marsh station, due for commissioning in 1963, it was likely to be down to £40 per kW installed.

Future

There was every reason to expect that demands in the next 20 years would continue to rise at the same rate as in the past 20 years. Even if this was so, it would not be until 1970 that consumption per head in this country would equal present consumption per head in USA and Canada, and in those countries there was as yet no evidence of saturation. The probability was that plant capacity would have to be increased four times by 1980. This implied 44 stations, each with 1,500 MW capacity.

The problem of finding sites for such large generating units was considerable and was not lessened by the difficulty of obtaining routes for transmission lines acceptable to the public. Increased load capacity and some upgrading to 380 kV would be necessary on the existing lines and already work was in hand on a 500 kV design using bundled conductors.

Only marginal improvements in the highest station thermal efficiencies could be expected, although average thermal efficiency could be raised much closer to the best stations and improved instrumentation would enable running costs to be more accurately assessed. However, even a 0.1% improvement in average plant efficiency represented a saving of £800,000 p.a.

National coal production was likely to fall slightly to about 200 million tons annually, but it was reasonable to assume that the CEBB's share would increase from the present 20% to about 48% by 1980. By that time, nuclear fuel might well be giving 33.5% of the total output.

Much thought had been given to improving the present low load factor and reducing cost of supply. The annual load factor was at present 47%, and although every effort was being made to develop "off peak" loads it was doubtful if a substantial change in load factor could be brought about. Although as much as 20% of annual demand was lasted for only less than 6% of the year, it was not considered economical to install new plant, such as gas turbines, for peak load use but rather to provide high

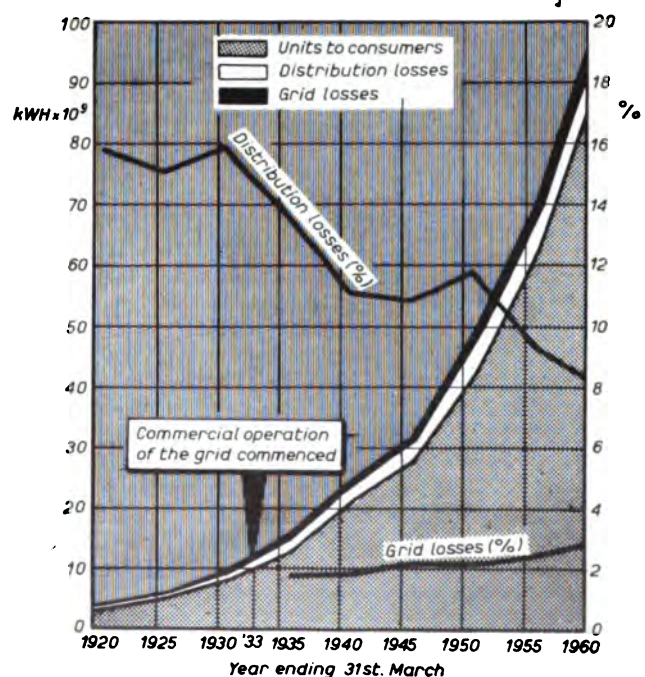


Fig. 1. The steady reduction in distribution losses is shown by this graph. In the ten years after the grid was introduced, distribution losses fell from 15.9% to 11.1%. Overloading subsequent to the war resulted in increased losses in 1945-50.

merit plant to meet load growth and to operate fully amortised plant for short periods. Nevertheless, the South Western Board's 3 MW gas turbine installations were being watched with interest and the CEBG had recently ordered an experimental 15 MW gas turbine.

In concluding his address, Mr Thirtle referred to some of the research projects being pursued by the CEBG. The laboratories at Portishead were concerned with efficient oil burning, metal corrosion, burning of low-volatile coals and extended use of powdered fuel ash in cement products. The Board's application branch was examining problems of energy conversion previously referred to.

For example, in the MHD generator, although there was considerable difficulty with high temperature electrodes, by using a pulsating gas flow and fluctuating magnetic field, an a.c. electrical output could be induced in a separate system and the mean temperature of the hot gas system could be reduced.

Another project, concerned with hydraulic transport of coal over considerable distances, suggested that transport costs could be reduced to 40% of that by rail and ship for a distance of 150 miles.

In the last five years telemetering had improved, giving the control engineer more immediate information. Computers were now being considered to give economic operation with security of supply. Such computers would be supplied with data on load requirements and plant and system conditions, and would require a memory of plant characteristics and past load conditions.

The Telephone System

Aspects of the GPO system were described by two of this year's IEE chairmen. At the Southern Centre, Mr R. Goford, M.I.E.E. (Area Engineer, Portsmouth telephone area), outlined the structure of the telephone system and the duties of the staff.

Growth of the system, with particular reference to recent developments, formed the subject of the address to the South Midland Centre by Brigadier F. Jones, C.B.E., E.R.D., M.Sc., M.I.E.E. (Telephone Manager, Birmingham area). He referred to the great advances which had been made possible, first by the introduction of automatic exchanges, and more recently by electronic techniques. Without the automatic exchange, the telephone system would have been virtually unworkable. Even though 80% of subscribers were connected to automatic exchanges, 50,000 operators were still employed.

The transistor, by reducing power and space requirements for telephone equipment, had made economical the introduction of electronics on a wide scale. An example was the recently introduced subscriber trunk dialling system which used electronic register translators to route subscribers' calls. A later design utilised magnetic drum storage. One such drum could accommodate 32,000 digits, and only four drums would be necessary to handle all outgoing trunk calls from the Birmingham area. Electronic techniques were also being applied to accounting. At present, preparation of the subscriber's account cost 10s. Since with STD all calls were billed together and individual calls could not be identified, it was considered necessary to submit accounts quarterly. Electronic accounting methods were being developed for automatic accounting, again using magnetic storage drums.

Two systems of economising in cable requirements were under investigation. In the first, a line connector was used designed to exploit the very small time for which the average subscriber's line was normally in use. Switching equipment in the local distribution system would connect one of a group of subscribers to a common line,

so enabling the line to be more fully used. The second development was based on the Time-Division-Multiplex system used in telegraphy. For example, 100 subscribers might be connected through high-speed electronic switches to a single line for successive periods of 1 microsecond. Thus 100 conversations could be carried over a single transmission channel without excessive discontinuity or distortion of speech.

Science in Mechanical Engineering

THE place of science in mechanical engineering today was discussed by I.Mech.E. President, Professor O. A. Saunders, M.A., D.Sc.(ENG.), F.R.S., M.I.MECH.E. (Imperial College), in his inaugural address last week. Although this provided the principal topic for his address, there was much of broader interest for the engineer specialising in other branches of the profession.

Dealing with advances in science, Professor Saunders stresses that the engineer of the future will always need to combine scientific knowledge with engineering experience. The "cut and try" element is characteristic of the engineer's work and progress would be slow, if not impossible, without it.

Broadly speaking, science contributes to engineering developments in three ways. It introduces new principles through which engineers can achieve their aims; it discovers new materials and production processes; and it shows how to improve general and detailed designs of appliances.

One of the difficulties of engineering organisation today is that no great advance has been made in enabling the young man to gain support for new ideas. This is because there are far more ideas competing together than previously, and assessment is becoming more and more difficult. Judging the value of new ideas requires rare qualities of breadth of knowledge and perception in individuals faced with the task. Professor Saunders suggests that the task of organising to take full advantage of new scientific ideas and developments, and encourage young men without undue waste of material and manpower resources, offers one of the greatest challenges to the coming generation.

Speaking as a university professor, the president suggests there are three basic aims for engineering education. These are:

1. Broad fundamental knowledge of the engineering sciences, with some degree of specialisation based on adequate physics, chemistry and mathematics.
2. Ability to apply academic knowledge to engineering problems of design and construction, including gathering together information preparatory to making decisions involving both technical and human problems.
3. Ability to express effectively, verbally and in writing, the necessary information to be conveyed to others.

So far as school training is concerned, the four essential elements of sixth form education for those aiming at an engineering career should probably be physics with chemistry, mathematics, a language, and history. These would be appropriate when pressure to enter a university is less intense than at present.

Old Faradians Entertain

NGE of venue and day marked this year's Old ians dinner which was held last Friday at instead of, as on previous occasions, at the chairman of the Association, Lt.-Col. Reeves, explained when proposing the toast of i," this had been in deference to the guest of r Hamish D. MacLaren, K.B.E., C.B., D.F.C., f the I.E.E., who would, in the next 48 hours, he post of Director of Electrical Engineering at lty which he had held for so long and with such The task of handing over to his successor made nore convenient day than Thursday and this ready booked at the Savoy.

ish, replying for the guests, said that they all ie passing of the mighty battleships which, as the line, had so long held pride of place in our his did not mean the end of the Navy. On the ie service had a great deal to offer to the young f today, both in service and civil positions,

providing only that they had the technical training, ability, enthusiasm and an element of luck. He had, and he admitted it, had his share of the latter in his time.

Sir Harold Bishop, C.B.E., Director of Engineering, B.B.C., proposing the toast of "Faraday House," expressed the pleasure of all present at the appearance, his first after four months in hospital, of the Chairman of Board of Governors, Col. B. H. Leeson. As pioneers of the "sandwich system" which had produced so many outstanding practical engineers, the college could reflect with pride that it still remained self-supporting, unsubsidised and without any strings. Engineering students from all over the world had passed through its doors and would continue to do so for many years to come. Among the many distinguished guests present were Sir Leslie Gamage, M.C., Sir Josiah Eccles, C.B.E., M.M., Sir William McFadzean; Mr F. H. S. Brown, Deputy Chairman CEGB; Mr S. B. Warder, Chief Electrical Engineer, British Railways and Mr W. K. Brasher, C.B.E.

Clean Conditions Assembly Shop

PATING the difficulty of clean conditioning ex reactor components on site, Stewarts and .. Pipework Engineering Division decided to have installed a permanent clean conditions op. This is now in service and is integral with engineering section of the company's works at ear Glasgow.

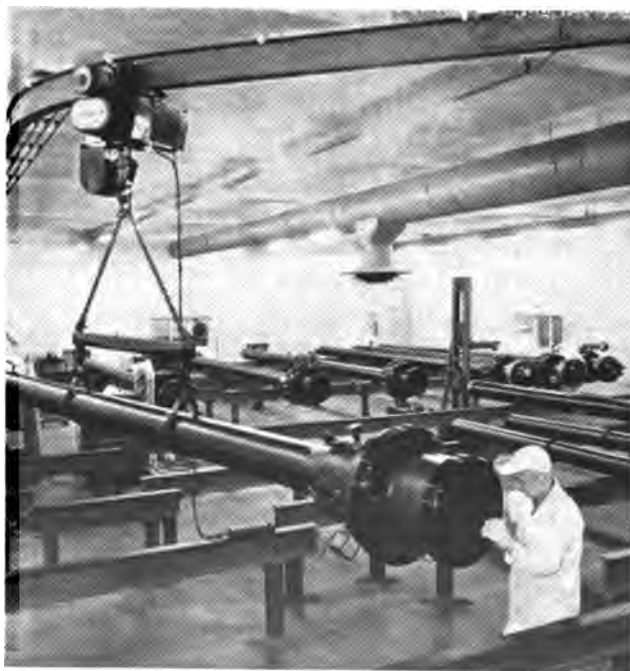
ssity for ultra-cleanliness of plant components radiation is well known. After preliminary shot-blasting and vacuum-cleaning, component eated with anti-rust coating and passed on for bly. The latter operations are carried out in rroundings where, also, the assembled parts off ready for dispatch to site. Efficient handling is important in order to prevent particularly between the shot-blasting and ges where delays might initiate incipient rust-amination. This requirement is fulfilled at the stallation by means of electric hoists running rail system.

recautions

ial clean conditions shop is immediately the degreasing and shot-blasting units and or area of 7,000 sq ft. It is partitioned into id is of dust-proof construction, having double l rubber-sealed doors. The shop is supplied cally heated air at a pressure several p.s.i. spheric and filtered to a dust particle size of ne-thousandth millimetre. The interior is well ished in non-contaminating gloss paint. To nimum standard of cleanliness, personnel must clothing and boots provided in a changing : entrance.

coating is applied to component parts in y of the clean shop by dipping. Several types are used, one being a synthetic lacquer districhlorethylene. The coating produced has

the particular advantage that when the component is installed in a reactor the lacquer can be removed by volatilisation. Noxious vapours emanating from the dipping trough are drawn into extraction fan intakes in the sides of the trough and dispersed. Coated components are passed on to the second bay, which has a slightly higher air pressure than the first bay, where final assembly is performed and the inner bores are sealed with polythene end caps.



Part of Stewarts and Lloyds Ltd. clean conditioning shop at Tollcross. Monorail hoist can be seen with plenum pressurised air duct in the background. Trilac coated components being assembled are fuel rod stand-pipes for Hunterston nuclear generating station

News of the Week

NATIONAL APPLIANCE SERVICING

Scheme for annual maintenance charge proposed

THE early establishment of a national service organisation for domestic electrical appliances, providing uniform attention, uniform charges and quick service, has been suggested by Mr N. A. H. Stacey, economic and marketing adviser to the General Electric Co. Ltd. Speaking at the annual dinner of the South Staffordshire branch of the Electrical Contractors' Association he stressed that the essentials of such a scheme were yearly contracts at fixed prices.

His idea is for a uniform annual charge for maintaining equipment in perfect running order. No one had a monopoly of the idea, somebody would adopt it sooner or later and it was going to be a success with the increasing number of appliances in use, he told the "Electrical Times." In the United States, the General Electric were experimenting with a similar scheme in two States at present.

There was an immense opportunity to add to consumer welfare, he judged, and the time to think about service for electrical goods on a national coverage was now. Mr Stacey told the ECA members that the problems of mass production had been tackled, and those of mass consumption and mass financing were being tackled; we now want to effect mass servicing.

Earlier he had referred to the important position of the electrical contractor and retailer in transmitting quickly the suggestions and criticisms of the customer to the maker about electrical products, not only by reporting faults, but consumer preferences for colour and shape, for performance and usefulness. What the dealer thought of a product was important, "but what the customer thinks is vital," he said.

The electrical consumer goods industry

was going through one of those periods of "readjustment" which have been taxing its ingenuity to the limit for the past ten years, but there was a prospect of better times, since the national economy was sound, consumer expenditure was still buoyant, and full employment was being maintained. But he urged that when credit restrictions were eased the industry should ask for a reduction of purchase tax on electrical goods. Purchase tax on electrical appliances, radio and TV, and certain other consumer items, totalled £106 million in 1959.

350 MW SETS FOR TILBURY

THE CEBG have received the consent of the Minister of Power to establish a 1,400 MW power station close by the existing 360 MW station at Tilbury. The first section of the new station, with two 350 MW sets and two coal-fired boilers of 2,450 klb/hr evaporative capacity, is to be in operation by 1965.

N. Ireland dispute settled

THE dispute over a claim by clerical and administrative staff of the Electricity Board for Northern Ireland for parity with employees in the electricity supply industry in Great Britain has now been settled. The dispute originated two years ago and, after lengthy discussions, negotiations broke down last September, as we reported on 29 Sept. Some 400 employees then staged a ten-day strike before returning to work last month to allow negotiations on the outstanding differences to reopen between both sides under the auspices of the Ministry of Labour. These differences have now been resolved.

REFRIGERATOR SALES FALL

SALES of refrigerators fell sharply in September, but the export picture is brighter. British manufacturers' deliveries to the home market were 65% lower than in September last year. Retailers took only 27,248 refrigerators against 77,106 a year earlier. But, following buoyant sales early this year, deliveries to the home market for the nine months to September were still 20% higher than in the corresponding period of 1959. Exports for the nine months were up 42%, totalling 107,104 units, and the higher level was maintained in September.

PYE-EKCO MERGER PROPOSED

A MERGER of the businesses of Pye Ltd. and E. K. Cole Ltd., involving a share exchange and the formation of a holding company, is proposed by the boards of both concerns. One reason for the amalgamation is the present difficulties in the television industry, but both boards are convinced that considerable benefit will accrue from the merger because of the availability of greater resources, and on account of the complementary nature of many of the subsidiary and associated companies of both groups, particularly in the export field. At the present time the Pye issued capital is just over £7½ million, and that of E. K. Cole nearly £1.6 million.

Under the merger, the identity and individual operation of both groups will be maintained under existing managements, with Mr C. O. Stanley (of Pye) as chairman of the new holding company and Mr E. K. Cole as deputy chairman.

The proposed terms of the share deal would be:

One 5s Ordinary in the Holding Co. for every 5s Pye Ordinary;

Three 5s Ordinary in the Holding Co. for every two 5s Ekco Ordinary;

105 Cumulative Preference 5½% £1 shares in Holding Co. for every 100 5½% Cumulative Preference £1 units in Pye, and

a similar exchange for Ekco Cumulative Preference shares.

187 Cumulative Preference 5½% £1 shares in Holding Co. for every 100 Ekco 7% Cumulative Participating Preferred Ordinary stock.

Both groups have a number of subsidiaries outside the radio and electronic sphere. Pye Ltd., for instance, in addition to its recently acquired Telephone Manufacturing Co., wholly owns such firms as L. G. Hawkins and Co., Lindley Thompson Transformer and Service Co., Unicam Instruments Ltd., W. Bryan Savage Ltd., Labgear Ltd. and W. Watson and Sons Ltd.

On the other side, E. K. Cole Ltd. has a major plastics business apart from a well-established electronics concern, a growing domestic electric heating section, and also has holdings in the lamp industry through Ekco-Ensign Electric Ltd., in which the majority holding is owned by Thorn Electrical Industries.

Signpost to Sizewell

REQUEST for further particulars in amplification of the tender for the Sizewell nuclear power station has been received by the English Electric Co. from the CEBG. This is taken in some quarters as indicating that the English Electric-Babcock and Wilcox-Taylor Woodrow nuclear energy group are likely to receive the contract for the station.

Early this year the Minister of Power announced his consent to the construction of a 650 MW station at this Suffolk coast site and at the time it was estimated that work would start in late summer. Subsequently, planned output from the station was reduced to 550 MW; but cooling water supplies and other features of the site are suitable for an output even greater than the 650 MW for which application was originally made.

Safety Code for Building Contracts

MENT of safety officers is required for building contracting firms regulations under the Factories Acts published by the Ministry of last week. The new regulations extend to the civil engineering industry the safety code already applying to the building industry and add new ones, some with electrical significance.

as the Construction (General Regulations), the new code covering demolition operations and works involving construction as defined in the Factories Acts. Any contractor who is required to work to which the regulations apply, and who normally employs a total force of 50 or more, will be required under the regulations to employ one or more experienced safety officers. Duties will include advising on safety matters and general supervision over compliance with safety regulations.

Additional requirements written into the new regulations cover demolition precautions, power lines and lighting. In connection with demolitions, the present regulations (79(3) of the Building Regulations) are largely repeated. This calls for cables to be kept dead during demolition work.

The new regulation effectively requires that requiring "adequate and proper lighting for all working places" be approached to them.

Over the years have seen much trouble with overhead power lines striking building sites. A new regulation requires that "all practicable precautions shall be taken" to prevent danger from overhead lines "either by provision of protective screens and suitably placed barriers or by other means."

Additional requirements for fencing and barriers to be used on building sites and

civil engineering sites are written into the new draft regulations. All machines built after the regulations become law will have to have protection for specific parts, such as revolving shafts, gearing, flywheels, belt, pulley and chain drives.

Another set of draft regulations is the Construction (Lifting Operations) Regulations, which deal with the construction, use and examination of all lifting appliances, gear and tackle used in building and civil engineering operations.

Women urge H.P. safeguards

THE National Council of Women wants hire-purchase agreement forms to be left with the buyer for four days as a "cooling-off" period before the buyer signs. The annual conference at Scarborough carried by a large majority a resolution urging the Government to introduce legislation which would protect housewives from high-pressure salesmen. Other points in the resolution were that the forms should be in bold type throughout and show clearly the basic cash price and total interest, and that the buyer's signature be witnessed by a third party.

CAPITAL FOR NATIONALISED INDUSTRIES

CAPITAL investment by the CEEB and the area boards during 1960-1961 is put at £298.3 million in a White Paper on public investment published on Tuesday. Of this, area board investment amounts to £95.3 million. Corresponding figures for 1961-62 are £318.0 million and £103.4 million for area boards. For the South of Scotland EB capital spending is estimated at £26 million for 1960 and £24 million for 1961. Distribution expenditure in the two years being £8.8 and £9.0 million respectively. Corresponding figures for the N of S HEB are £12.4 million and £16 million, with £3.1 and £2.6 million to go on distribution projects. The CEEB and area board figures for 1960-61 are revisions upwards of totals earlier approved by the Minister.

STEEL PRICES UN-CHANGED

THE Iron and Steel Board has decided not to make any general increase in steel prices as the result of the higher cost of coal and coke but, because of the increases in costs, further steel price reductions such as have been made during the past two years will be impossible, they state.

Further changes which may be made this year in iron and steel prices are likely to be limited to a few products only, or to details of price structure.

in Australia . . .

al Industries group is reorganising Australian interests. The wholly owned subsidiary, Lancashire Dynamo Ltd. of Melbourne, is being merged with Godfrey Electrical Industries of Sydney, and a new company is to be formed to take over both firms. Lancashire already owns half the equity and a majority of its capital, and has now purchased the remainder of both classes of shares. The new company will be known as Lancashire Australia, with Mr W. J. (formerly commercial director of Australia) as chairman, and Mr Buckingham (formerly general manager of BICC (Australia) as managing director.

. . . and Petbow-Pye

An Australian company with a capital of £250,000 has been formed as Petbow-Pye Industries Ltd., of Australia. It is formed from premises at Huntingdon, Victoria, and the plant will extend its operation to cover the Petbow range (engine-driven generators, welding equipment, mobile switchboards, etc.), also the range of "Magnicon" alternators supplied to the Macfarlane Engineering Ltd.

NEW STEELWORKS FOR T.I.

A NEW integrated iron and steel works, estimated to cost nearly £60 million, to produce some 425,000 ingot tons of steel a year, is proposed by Tube Investments Ltd. for its subsidiaries, Park Gate Iron and Steel Co. The new development will be on a site adjacent to the latter's present works at Rotherham. The scheme provides for ore preparation and sinter plants to feed a blast furnace of 26½ ft hearth dia. The new steel-making plant will have two 75-ton Kaldo furnaces, fed by hot metal, and one 75-ton electric furnace, fed by scrap. The choice of the Kaldo type was influenced by the nature of the home ores to be used. Of

Swedish origin, its vessel rotates and steel is produced speedily with the aid of oxygen.

Ingots will be rolled on a blooming mill, followed by a continuous billet mill. Finishing will include a 10 in. continuous rod and bar mill and a continuous narrow strip mill.

To feed the new blast furnace, supplies of ore will be increased from the company's own fields in Leicestershire, Northamptonshire and Lincolnshire.

Building is scheduled to begin next year, with capacity output achieved in 1964.

After the opening of English Electric Hse by Lady Nelson last week, Lord Nelson of Stafford, chairman, is seen showing the original 2LO radio transmitter to Lady Nelson



SCOTTISH HYDRO UNDER FIRE

TWO new guns have been levelled at the North of Scotland Hydro-Electric Board—the National Trust for Scotland have now asked for a reappraisal of the question of generation and distribution of electricity in the Highlands, and the newly formed Scottish Power Investigation Committee intend to press for a public inquiry into hydro-electric development plans.

The National Trust have asked the Secretary of State for Scotland to initiate immediate consultations between his departments and the Board. The Trust maintain that existing statutory arrangements governing the development of water power resources were arbitrary, outmoded and wholly unsatisfactory.

There were no means of obtaining a re-examination of a hydro-electric project until the Board published their scheme. Once it was published, there were only 40 days in which to consider the implications, and no objection could be made effectively unless it was pressed to the point of a public inquiry, they state.

"This is no way in which to treat

hydro-electric development either as an element in an expanding Highland economy, in which it is indispensable, or as a factor in land use and the conservation of wild or semi-wild territory, which has increasing importance as a tourist attraction," the statement adds.

The Trust are prepared to carry objection to the Board's Nevis scheme to all legitimate lengths.

The other organisation—the Scottish Power Investigation Committee—who have Sir John C. Henderson as chairman, have among their objects:

(1) To secure the necessary provision of power for the Highlands by the most economic use of the country's natural resources of fuel, compatible with the interests of the consumers, taxpayers, tourist industry, public recreation and the conservation of amenities;

(2) to press for an independent public inquiry into plans for hydro-electric development in the Highlands;

(3) to draw attention to the dangers of proceeding with such development without an inquiry; and

(4) to oppose at public hearings any schemes by the electricity authorities which, in the view of the Council, are badly conceived in regard to economic, amenity and other considerations.

Outlining the Committee's views, Sir John stated that while they were anxious that electricity distribution in the Highlands should proceed by the best and most economic means, present factors strongly suggested that thermal stations generating in the south and distributing to the Highlands would mean cheaper electricity and be better for Scotland.

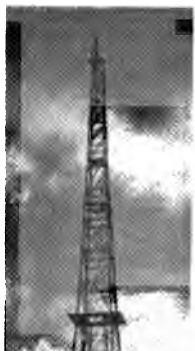
MARKING OF IMPORTS

PERMANENT magnets and a variety of hand tools are included in provisions of a new draft of the Merchandise Marks (Imported Goods) Order. This prohibits the importation into and the sale in the UK of such goods unless they bear an indication of origin. It stipulates that each article shall be die-stamped, etched or engraved with this indication, and the carton or container must also be stamped or printed.

This Draft Order was laid before Parliament on 25 Oct., where it has to lie for 40 days.

THAMES CROSSING

Nearing completion are the two 630 ft towers to carry the 275 kV line between West Thurrock and Northfleet. The cross-arms have yet to be added and stringing will take place next summer. The tower on the Kent bank is shown in the foreground, with the Essex tower in the distance. Span between the towers will be 4,500 ft with a minimum clearance of 250 ft above high water.



Coal's Future in Scottish Generation

THAT coal is expected to remain the backbone of power production in Scotland for the next decade is evident from papers presented at a Resources Symposium in Edinburgh this week. Although yield from the once prolific Lanarkshire and Ayrshire coalfields is dwindling, economic workings have been developed in the Lothians, Fife and Stirlingshire to supply base-load power stations such as Kincardine and a 1,200 MW station, projected for 1967-70, in the Lothians.

About one-third of Scotland's electricity comes from water-power, representing only a quarter of the country's hydro-electric potential, but further exploitation is at present uneconomic relative to other means of generation. Thus, if demand continues to increase at the current rate of 7% per annum, alternative means must be found to augment total supplies. Nuclear power in conjunction with pumped-storage is the most promising alternative; the 360 MW Hunterston station is a first step in this direction.

OFFICIAL PUBLICATIONS

Public Investment in Gt. Britain. Cmd. 1203. HMSO. 1s 9d (see page 695).

Draft of Merchandise Marks (Imported Goods) No. 1 Order, 1960. HMSO. 3d (see this page).

Rationalisation of Electric Power Consumption. UN Report. 2s 6d.

Construction (General Provisions) Draft Regulations (9d), and Construction (Lifting Operations) Draft Regulations. (1s). Both HMSO (see page 695).

Tariff assessment of dual-purpose rooms

IN view of the increasing trend in domestic architecture for dual-purpose rooms incorporating living and dining areas, the Southern Electricity Board is soon to amend the existing tariff regulation. The Board maintain that such dual-purpose rooms shall be assessed as two rooms for tariff charges. Mr R. R. B. Brown, chairman of the Board, told Consultative Council members recently that until the new regulations were introduced they would not enforce

their interpretation in any dispute that might arise. He pointed out that when the regulation was drawn up over ten years ago it included a proviso that "rooms with structural divisions such as fixed or folded partitions count as two or more rooms, as the case may be." Since then a new feature had arisen and was not covered by the regulation.

One example was a room with a buttress on each of two opposite walls and a beam across the ceiling, with one end being used as a living room and the other as a dining room. In another extreme example of open planning there were no complete rooms as such, but the whole space was divided into compartments by half walls and other architectural features designed to give an illusion of separate rooms. He maintained that it would be quite inequitable for floor areas serving as two rooms and with appropriate electrical installations to be assessed other than as two rooms. The alternative was a total floor area assessment as opposed to numbers of habitable rooms, but this also aroused arguments, he said.

B.E.A.M.A. exhibits at Cologne Fair

BRITISH domestic appliances will again be displayed collectively at the International Household Goods and Hardware Fair at Cologne next year as part of the British Electrical and Allied Manufacturers' Association's export drive in the European market. Nine firms will be represented, they are: Berry's Electric, Corfield-Sigg, Dimplex, Radiation Ltd., EE, GEC, Heatrac, Simplex Electric Co. and Thorn Electrical Industries. No further applications to participate can be accepted, BEAMA says, as arrangements have been finalised. The Fair will be held from 24 to 27 Feb.

Mr S. F. Steward, director of BEAMA, said the Association was determined to make the exhibit at Cologne one of the spearheads of the continuing drive to do more business with Europe. BEAMA had urged the Government to help their export drive by creating stability in credit controls at home, which was so important in keeping unit costs down, Mr Steward added.

A recent survey by BEAMA estimates that £1,900 million will be spent on domestic electrical products by consumers in the Common Market countries from 1959 to 1963.

Instrument maker links with New York Co.

DRAYTON Regulator and Instrument Co. has formed a partnership with the New York hospital apparatus maker, Wilmot Castle Co., to make a wide range of hospital equipment, including operating tables and sterilisers. Manufacturing will be carried out by Drayton Castle Ltd. at new works in West Drayton.

Mobile switchgear showroom

SWITCHES and fusegear manufactured by Johnson and Phillips Ltd. will be shown during the first tour of a new mobile showroom commissioned by the company. The showroom takes the form of a 27 ft by 7 ft 6 in. trailer which will be towed by a Bedford eight-diesel prime mover to sites throughout the country. It will show J and P switchgear, transformers, capacitors and cables to parties of engineers from electricity boards, the NCB and the larger industrial companies. Incorporated in the trailer is an ample exhibition space, attractively panelled in sapele mahogany, together with reception accommodation and a small kitchen.

Exhibition at Sales Conference

AN exhibition of domestic appliances is to be staged in conjunction with the EDA Sales Conference at Harrogate from 28 Feb. to 3 March next. EDA are now inviting applications from manufacturers for space. The exhibition will normally be open for delegates only on the first three days, but will be open to the trade on the Friday.



Officially opened last Friday by Mr Peter Thorneycroft, Minister of Aviation, the new Applied Electronics Laboratory of the General Electric Co. Ltd. at Portsmouth, shown above, is one of a group of three operated by the company on behalf of the Ministry. It is engaged on research and development for defence purposes

ELECTRICAL DISPLAY AT MOSCOW FAIR

BRITAIN and Russia will exchange trade fairs next year. At Sokolniki Pk, Moscow, from 19 May to 4 June, Britain will stage the largest foreign exhibition ever to be held in the USSR. A big Soviet trade and industrial exhibition will be held at Earls Court from 7 July to 29 July and, at the same time, Russian cultural events will be staged in London theatres and concert halls.

The electrical industry will be well represented at Moscow. Of the 621 British firms participating, 48 are electrical engineering companies. English Electric will exhibit the various methods of generating electricity; the display will include a model of a nuclear power station and a new colour film, with Russian commentary, on the first 500 MW nuclear power station at Hinkley Point. Visitors to the AEI

exhibit will see a mass spectrometer which enables impurities in materials to be detected down to one part in a thousand million; two of these spectrometers have just been ordered from AEI by Russia.

The British fair is being organised by Industrial and Trade Fairs Ltd. Mr J. B. Scott, a director of Crompton Parkinson and chairman of the Russian Section of the London Chamber of Commerce, has been appointed committee chairman of an advisory council set up to help the organisers. Mr G. H. Jolley, a director of AEI (Export) Ltd., is also on the committee. The two fairs are jointly sponsored by the Association of British Chambers of Commerce and the All-Union Chamber of Commerce of the USSR.

Sokolniki Pk, where the British Fair will occupy a 23-acre site, is comparable to London's Hyde Pk. The Soviet authorities estimate that one million Russians will pass through the turnstiles. In addition to using the two halls built by the Americans for their exhibition last year, the British will pay 25% of the cost of two more halls now being built by the Russians. As a gauge of size, 2,000 Britons will be going to Russia to stage the fair, compared with 80 Japanese at their exhibition in Moscow this year.

NEW OFFICES FOR N.W.E.B.

A £765,000 contract has been awarded to J. Gerrard and Sons, of Swinton, Lancs, by the North Western Electricity Board for the demolition of existing buildings in Dickinson St, Manchester, and the erection of a nine-storey office block, an entrance block and a new sub-station. The project is due to be completed in October, 1962.

NEED FOR CONCESSIONS IN EUROPE

BRITAIN was not prepared to pay any price for a *rapprochement* between the Six and the Seven, but bridging the gap was bound to call for considerable concessions on both sides, Mr Reginald Maudling, President of the Board of Trade, said last week. Addressing the annual conference of the Institute of Directors, he said a unified Europe was of fundamental importance to the British economy. Unfortunately, the suggestion was not true that Britain only had to make up her mind and the barrier would be down. The simple fact was that until recently the Six had not been willing to negotiate. Now both sides were seek-

ing a basis for negotiation, and that in itself was encouraging, he said.

The Chancellor of the Exchequer, Mr Selwyn Lloyd, told the Conference that the reduction in Bank rate to 5½% did not mean a change in the policy of credit restriction, but simply a realignment with rates overseas. Restraint was still needed and Bank rate, bank advances, and restrictions on credit and hire-purchase were the right weapons to do the job, he said. Recent appeals for stable hire-purchase conditions have apparently not influenced Government thinking yet.

CONTROL CUTS CHICKEN COSTS

HIGHLIGHT of EDA's stand at this year's Dairy Show at Olympia was, undoubtedly, electrical broiler-house control. Modern controlled-environment poultry-rearing methods can, we are told, produce an economically priced bird, plump for the supermarket, in from three to six months. This scientific mass-production process centres round the broiler-house, a thermally insulated wooden structure. Here, incubator-hatched chicks, after a period under an infra-red "brooder," begin a nether-world existence. As potential broilers they will be subjected to light cycles of varying colour and intensity, in even-temperature surroundings, and forced-fed at regular intervals on a carefully prepared diet.

The process is complicated in practice by temperature, food and light cycling times having to be related to the stage of growth of stock. Ventilation, too, is important and must at all times be adequate. Feature of the EDA exhibit was a self-contained unit by means of which these variables can be controlled. Available for about £150, the unit can be set for either manual or automatic control. Temperature control and ventilation are effected simultaneously by extraction fans. The unit keeps temperatures within specified thermostatic limits, maintaining sufficient ventilation in winter months and enough cool air in

summer, by fan cycling. Should extreme weather conditions cause uncontrollable temperature fluctuations, an overriding thermostat operates an alarm. Light cycling is somewhat arbitrary, depending a good deal on individual opinion, so provision is made on the control unit for switching a variety of timed sequences of red, blue and white light. Feeding-stuff distribution in the broiler-house is by mechanical conveyer which, of course, lends itself to control by the unit.

S.T.C. puts sound in Lagos Parliament

AN elaborate sound system has just been installed at Lagos by Standard Telephones and Cables in the new National Hall, meeting place of newly independent Nigeria's Legislative Assembly. Apart from amplification through 150 loud-speakers concealed in the back of alternate seats, the system provides for simultaneous translation into six languages and the recording of proceedings on tape machines. Sixteen microphones are suspended over the assembly and Mr Speaker and the clerks have their own microphones and a local loud-speaker. Microphones in various areas can be faded out from a control panel and the Speaker also has a button to fade out other microphones when he wishes to be heard.

E.R.A. new work

WORK recently started by the ERA includes four surge phenomena subjects and two heating topics, according to the recently published October number of *Co-operative Electrical Research*. The subjects are:

Investigation of cause of flashover on 120 MVA auto-transformer at Uskmouth for South Wales Division.

Study of the causes of damage to telecommunication cable and measurement of impulse breakdown voltage.

Investigation of suspected surge voltages in a circuit for testing supply meters. Impulse tests on sample stator coils in conjunction with corresponding a.c. tests in the Materials Department.

Use of a network analyser to study thermal storage phenomena in suspended floors.

The effect of a very high degree of thermal insulation below cable level on the performance of floor-heating systems in flats in London.

Also in the October issue are articles on the rating of high-power circuit-breakers, and on ERA and CISPR activities in the field of radio interference.

Orders at high level

ORDERS on hand of the engineering and electrical goods industries at the end of August were at the highest level for the past three years. Home and export orders were both about 20% higher than a year earlier. Production in July and August was higher than last year, but with the holiday season curbing output, delivery dates lengthened considerably.

Electrical engineering output eased slightly in June, the Board of Trade estimates. For the second quarter, production was about 5% below the first quarter of this year and 11% short of the record level reached at the end of 1959.

GOVERNMENTS' CAUSE HIGH PRICES

THE knotty problem of commodity price stabilisation has been looked into by the Purchasing Officers' Association. After a 15-month investigation, a research committee has come to the conclusion that any successful scheme must remove the causes of price fluctuations, rather than attempt to control the price. The committee puts much of the blame for erratic prices on the policies of Governments. The tariffs and quotas against lead and zinc imposed by the US are an extreme example of a Government upsetting prices, says the report. Dumping, stockpiling and subsidisation by various Governments have also been major unsettling factors, often with harmful effects on the economies of producer countries.

GITRINE ON MANAGEMENT

EXPERIENCE with the electricity supply industry, as well as in other sections of industry, was drawn on by Lord Citrine when he spoke last week in a House of Lords debate on responsibilities of management. Lord Citrine suggested that "public accountability," a phrase commonly applied to nationalised industry, would more and more emerge as a relevant factor in considering the problems of private industry.

He expressed his belief that management could be taught as a subject, provided some natural aptitude was present. However, ability to handle people was becoming even more important than technical qualifications.

Lord Citrine said experience had shown him that managements given the right type of lead would follow without much trouble. In carrying out the principles and purposes of the Electricity Acts, he had never discerned, in any organisation with which he was connected, anything in the form of organised opposition by management.

There had been misunderstanding and hesitation, but nothing more. These difficulties had disappeared when matters had been fully explained. Early experience with nationalisation of electricity supply had convinced him that it was necessary to personalise management—it was not possible to work on a basis of anonymous titles.

In another part of his speech, Lord Citrine said he was sure there was greater reluctance on the part of the British people to adopt new ideas than there was on the part of most residents of other countries.



Aiding flood victims in Somerset, AEI-Hotpoint participated in an emergency washing centre at the SWEB's showrooms at Taunton. The clothes were also dried and ironed on the spot. AEI-Hotpoint also sent a battery of washing/spin drying machines to Exeter for a similar scheme there

Ministry to reconsider Euston-Crewe electrification

SH RAILWAYS' modernisation plan for the main line from Euston to Crewe, on 50 c/s electrification, is to be reconsidered at Ministry of Transport level. While, no new contracts for the scheme are to be placed, although the MoT, Marples, says there is no question of cancellation of existing contracts and under them has continued.

renewed look at the London-Midland electrification scheme was faced during a debate on the rail in the House of Commons last which took account of the recent of the Select Committee on Rationalised Industries on the subject (THE TIMES, 28 July). That report ed the methods of estimating em- by British Railways but suggested the London-Midland scheme ought carried through now that it has o far.

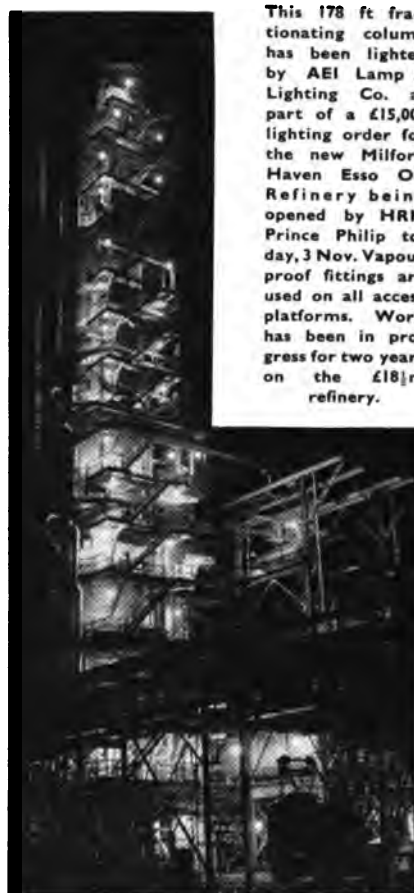
best estimate for the cost of London and modernisation (which includes work only incidental to electrifi- a) is £160 million. The Parliamentary ary, MoT, pointed out in the debate this was eight times the cost of the "We have to decide in the long run her to go in for the London-Midland rification scheme, or use some of the ry on other forms of transport."

BTC has carried out a reassess- of the electrification scheme in the of its experience elsewhere and this ler "urgent examination" by the ry.

ing the debate in general there vidence of concern about whether ld be possible to make the rail- self-supporting in anything like resent form. But Mr Marples re- forthrightly all suggestions that ld be possible to do without a ys system in the UK. On the other

hand, he pointed out that gross takings/ man/year in British Railways were only about £880. He announced that he had set up what he called a "compact study group" under his own chairmanship which is preparing a revised modernisation plan. The BTC was represented on this group. He promised a White Paper setting out the Govern- ment's proposals.

Sir Toby Low, who was chairman of the Select Committee whose report was much referred to in the debate, said that now the London-Midland electrification scheme had gone so far it should be completed as soon as possible. Mr A. Albu, a professional engineer by training, spoke of "magnificent achievements made in a very short time by very small staffs in electrification." He said British Railways and the electrical manufacturers, in organising the recent conference and exhibition, had done much to help exports. He understood that six countries had already adopted the 25 kV 50 c/s standard and more were likely to do so. However, he called for a big increase in the professional engineering staffs of the railways.



This 178 ft fractionating column has been lighted by AEL Lamp & Lighting Co. as part of a £15,000 lighting order for the new Milford Haven Esso Oil Refinery being opened by HRH Prince Philip today, 3 Nov. Vapour proof fittings are used on all access platforms. Work has been in progress for two years on the £18m refinery.

ORDER FROM BRITISH RAILWAYS

URTHER £5½ million worth of locomotives and shunting equip- has been ordered by the British port Commission. The contracts 50 1,700 h.p. main-line diesel otives with hydraulic transmission 8 350 h.p. engines with electric ission for diesel shunting loco- s. The main-line diesels are all estern Region as part of the pro- e to replace steam. Forty-one of unters, which are being built in orkshops, are for Western Region 0 for London Midland Region.

Ham's annual dinner

prospects for the battery industry a down turn in the motor trade emphasised by Mr John Oldham, at his company's thirty-first motor dinner held at the Connaught last week. Over 450 guests heard Oldham call for a revision of the stem and a more realistic attitude ports by the Government. Mr d C. Oldham replied to the toast ar Hosts," proposed by Mr R. E. u. The evening concluded with a t presented by David Berglas, Henderson and others.

GROWTH OF FIXED PRICE TENDERING

THE two main problems now affecting electrical contractors were, first, the acute shortage of electricians and, second, the insidious growth of fixed-price tenders under conditions where the forecasting of costs for years ahead made tendering of work a huge gamble in which the cards were stacked against the contractor, stated Mr J. Y. Dick, president of the Electrical Contractors' Association of Scotland, speaking at the Association's diamond jubilee dinner last week.

Looking at labour relationship, he said that by and large Scottish conditions were sound. The growth of the unions had forced a parallel growth in the employers' organisations. The activities of the latter had been curbed to some extent by the Restrictive Trade Practices Act. There were many who believed that some similar curb on unions was overdue.

On the current phase of mergers and takeovers, he thought the changes were disquieting despite the assurances of the courteous circulars to the contrary. He believed the natural buoyancy of the industry would not be impaired and that new patterns would emerge to provide a stimulation for the whole industry.

Electronics consortium

A CONSORTIUM of five British electronics manufacturing companies has been formed on the recommendation of the Ministry of Aviation to exploit the overseas and British markets for a major air-to-ground multi-channel telemetry system developed by the member companies in collaboration with the Royal Aircraft Establishment, Farnborough. The manufacturers participating in the consortium are Elliott Brothers (London), McMichael Radio, Rank Cintel, Southern Instruments (Contracts), and W.S. Electronics.

RADIO SHOW, 1961

NEXT year's National Radio and Television Exhibition will be held at Earls Court from 23 Aug. to 2 Sept. A preview for special visitors will be held a day before the opening. The show will mark the silver jubilee of television programmes, first seen at "Radiolympia" in 1936.

E.D.A. speaking contest

ENTRIES will close on 1 Dec. for the 1961 EDA Public Speaking Competition. Competitors, who must be employees of the electricity supply industry and under 35 years of age, may speak on "Modern Trends in Kitchen Planning," "Hobbies," "Some Lesser-known Uses of Electricity," "Keeping Warm," or their own subject provided it is connected with the use of electricity. Electricity boards will begin their area competitions early in the new year and the finals will be held in London in May.

U.N. Plans Thermal Station Study

STUDY of several aspects of thermal power station design and construction has been approved by the UN Economic Commission for Europe's Committee on Electric Power. At a meeting in Geneva last month, a group of experts was set up to investigate burning of fuels of low volatile content, use of waste combustion products from power stations, corrosion of air heater surfaces when oil is fired, and general trends in station design.

Also agreed was a meeting in Warsaw, Poland, in the spring of 1962 to consider a symposium of reports on "rational consumption of electric power," by which is meant increase in thermal and economic efficiency, including steps to improve load factor and power factor. The committee had before it at its meeting statistics suggesting a high level of rate of increase in electrical energy consumption in Europe at the beginning of the year.

Semiconductor Research

RESEARCH into the plastics deformation of semiconductor materials, germanium and indium antimonide, is being carried out at the Royal School of Mines, Imperial College, in an attempt to learn more about the effect on electrical qualities of geometrical defects in the crystal lattice and of chemical impurities in such extremely pure materials. Notes on this work are included in the school's research report for 1957-60, recently published. Amongst other work discussed is experimental investigation of electro-magnetic prospecting for metallic ore bodies, which is being used increasingly.

Sayings OF THE WEEK

"Let us bury the idea that retailing is simple and let the electrical trades be pioneers in making retailing a highly skilled occupation." . . . N. A. H. STACEY (of GEC), at the annual dinner of South Staffs branch of Electrical Contractors' Association.

"I have no hesitation whatever in saying . . . that there is a greater reluctance on the part of British people to adopt new ideas than there is on the part of most residents of other countries." . . . LORD CTRINE, speaking in a House of Lords debate on responsibilities of management.

"Teachers should not only refrain from appearing to be omniscient, but should even lead those whom they are responsible for into the realm of the unanswered questions." . . . SIR CYRIL HINSHELWOOD, at Imperial College Commemorative Day.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Tuesday, November 1					
	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	220½	+½	ZINC, virgin, min. 96% purity (cash) ...	88½	-½
" (3 months) ...	222½	+½	" (3 months) ...	86½	-
LEAD, refined pig. 99.97% purity (cash) ...	68½	+½	RUBBER, per lb No. 1, RSS, spot ...	26½d	-½d
" (3 months) ...	69½	+½	c.i.f. basis, ports. Jan. ...	26½d	-½d
TIN, refined, min. 99.75% purity (settlement) ...	796½	-4½	ARMOURING: Galv. Steel Wire (0.104 in.) ...	66½	-
" (3 months) ...	796	-	Mild Steel Tape (0.04 x 1½ in.) ...	53½	-
ALUMINIUM, ingots 99.995% wire bars (4 x 4 x 54") ...	186	-	NICKEL (home) ...	600	-
BRASS Strip 63/37 ...	193½	-	MERCURY (76 lb flask) ...	70½	-
SILVER (Troy oz) ...	197½	-	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	-
	79½d	-	Lead. (New York) ...	12c	-

* Tape Price, now an average, includes varnishing

Fuel in Birmingham's Redevelopment

THE present redevelopment of Birmingham City, referred to by Ald John H. Lewis, O.B.E., J.P., deputy mayor of Birmingham, as the greatest redevelopment plan in the world, was the main subject of speeches at the Birmingham Electric Club annual dinner recently. The club members' contribution to the city's prosperity was also referred to by Mr J. R. Anderson, president. Birmingham continued to grow in stature, he said, and it was doubtful if the redevelopment in the city centre, whether it be in roads or buildings, could be matched anywhere in the world.

It may well be, though, that long before the new buildings reached their "half-life" it would be found that the liquid fuel they were using would be the most expensive form of heating because figures showed that during the past two decades, despite outside influences, the increases in the average price of electricity had been far less than those of competing fuels, and this trend was likely to continue. The large build-

ings under construction in the city centre would make demands on the electricity supply system as great as many large industrial consumers.

Mr A. R. Leith, senior vice-president of the Club, proposed the toast to the guests, and the response was made by Sir Robertson King, K.B.E., chairman of the Electricity Council.

Sailing round the world

SPEAKER at the October luncheon of the Batti-Wallahs' Society was Major H. W. Tilman, who held the close interest of members and guests with an account of long distance sailing in small craft. The next luncheon of the Society is to be held on Wednesday, 30 Nov., when the speaker will be Mr K. Beken, marine artist.

News in Brief

"Electronics at Work" is to be the subject of the concluding lectures commemorating the twenty-fifth anniversary of Ultra Electric Ltd., which is to be held at a special session for school-children in the Royal Festival Hall today, 3 Nov., at 2.30 p.m.

Brook Motors Ltd. have produced a new 16-mm colour sound film of the story of a Yorkshire river, including manufacturing sequences at several factories. It is available on free loan.

Tube Investments' Electrical Division recently held a five-day sales conference at the Grand Hotel, Folkestone.

The Heavy Plant Division of AEI Ltd have received manufacturing instructions for mine-winders worth over £230,000 from the National Coal Board and the Union Corporation of South Africa.

Berry's Electric Ltd. have evolved a new demonstration stand for their "Magicmaid" food mixers which are to be featured in a TV campaign starting 4 Nov.

Eastern Electricity Board plan to open a new service centre in High St, Wisbech

Survey of Transducers

A LIST of available types of transducers, both current type and those under development, is being compiled by the Analogue Data Processing Technical Committee of the Electronic Engineering Association. The Committee is seeking the help of manufacturers or users outside the membership of the Association, who will be given the full results of the survey. A questionnaire indicating the information required is obtainable from the Association at 11 Green St, W.1.

PARSONS CHIEF'S LIFE

THE life of Sir Claude Gibb, chairman and managing director of C. A. Parsons and Co. Ltd., until his death in January, will be the subject of this year's Parsons Memorial Lecture. The talk will be delivered by Dr A. T. Bowden, chief research engineer for C. A. Parsons and a director of Nuclear Power Plant Co. Ltd., at Newcastle upon Tyne on 4 Nov.

Company Activities

It has been a long time since a Bank of England change has met with so little success, almost disregard, as did last year's cut from 6% to 5½%. The stock market barely murmured its recognition of the event. It had taken it for granted that the speech made by the Governor of the Bank of England at the previous week's bankers' dinner. That gave the market bordering practically on disclosure of a reduction was imperative in order to iron out some of the distortions which had been built up in international exchange rates, and distortions which were tending to the United States balance of payments deficit, creating distrust of the pound and stimulating the great "gold flight" which has so recently made headlines.

Here at home, the "squeeze" goes on. Selwyn Lloyd, despite the falls in the prices of domestic appliances, lower home production of overseas sales of motor cars, is adamant about that. Only three weeks after the cut had been made known, the annual conference of the Institute of Directors: "Some of us have been wondering whether the first sign of a change in our policy of restraint, of credit restriction, of anything of the kind." To John and to the citizen all this must seem a little strange, if not somewhat contradictory. The key to the riddle is that the United Kingdom and other European governments are choosing the lesser of two evils. It amounts to risking a premature raising of money rates, which would hurt their domestic economies do not want, thereby hoping to stem the flow of the dollar and prevent an other deterioration in international trade which would result from the US authorizing drastic defensive action.

In the City it all added up to no more than a mere 0.2 rise in the Financial Industrial ordinary index to 321.1. It can also be seen from my table alongside of electrical shares, too, showed no response.

Aluminium Co. Ltd.

In 1959-60 were a record, but increasing competition will make keen and marketing necessary if production is to be continued, Lord Plowden, chairman, warns. Confident that the demand for aluminium, particularly in the home, will increase substantially during the next few years, the company has taken steps to expand supplies. Arrangements for integration of the manufacturing activities of the company and of Reynolds Aluminium have been commenced since 1 Aug., the start of the current year, the facilities of the two companies have been operating as one group. It is anticipated that the relatively near future the output of Reynolds TI Aluminium will

One outstanding feature of the week, however, has been the rise in the price of ordinary shares of AEI. There has been a steady stream of investment buying here after they touched a new "low" of 42s 3d in the previous week.

The fall from 63s 10½d to 63s 4½d in the price of the £1 Ordinary shares of J. Lucas can in part be attributed to the trade returns which show that UK exports of passenger cars in September were at their lowest level since February, 1957. On further consideration of Plessey's bid terms for Garrard Engineering, the former's shares dropped from 52s to 50s 6d.

ELECTRICAL SHARE MOVEMENTS EITHER SIDE OF BANK RATE CHANGE (Middle prices at close of day's business)

SHARE	24 Oct.	26 Oct.	27 Oct. Bank Rate Cut to 5½%	28 Oct.
AEI £1 ...	42/9	46/-	47/-	47/9
BSR 5/- ...	50/7½	49/3	49/6	50/-
E. K. Cole 5/- ...	27/1½	27/6	27/3	27/6*
Decca 10/- ...	48/9	49/-	48/10½	48/6
EMI 10/- ...	43/9	44/6	45/-	44/3
Elliott-Auto 5/-	27/3	26/10½	26/10½	26/10½
English Elect. £1	34/-	35/-	35/6	35/6
GEC £1 ...	35/-	35/-	35/6	35/-
Hoover "A" 5/-	43/3	43/10½	43/7½	43/1½
J. Lucas £1 ...	63/10½	63/1½	63/1½	63/4½
Murphy Radio 5/-	16/1½	15/10½	15/10½	15/9
Parsons £1 ...	45/9	47/-	47/-	46/6
Philips £1.10 ...	11½	11½	11½	11½
Plessey 10/- ...	52/-	52/-	50/9	50/6
Garrard 1/- ...	3/7½	3/6	3/4½	3/6
Pye 5/- ...	16/6	15/10½	15/10½	15/6
Thorn 5/- ...	49/3	49/3	49/3	48/3
Vacetric 5/- ...	6/1½	6/1½	6/1½	3/9

* 22/3 in after-hours dealings following announcement of Pye-E. K. Cole merger.

One of the few items of company news was contributed by Crompton Parkinson, who are also participating members of Atomic Power Constructors. There was nothing "atomic" about the results, however, with the group profits before tax for the year ended 30 June, 1960, at £2,750,617 against £2,755,691 previously, and the increase in the dividend from the equivalent of 11.2% to 12½% made little impression on the price of the 5s Ordinary shares at 11s 1½d.—From our City Correspondent.

be merged formally into British Aluminium Co.

Contactor Switchgear Ltd.

Although the profit for the 12 months ended 31 July last declined slightly to £124,170 (£146,265), a final dividend of 10% maintains the total distribution at 14%. Taxation charge is £65,961 (£67,364).

Crompton Parkinson Ltd.

Although the group profit for the year to 30 June last declined slightly to £2,750,617, against the previous year's total of £2,755,691, dividend is raised from the equivalent of 11½% to 12½%, with a final of 7½%. Taxation absorbs £1,474,550 (£1,438,054), leaving a consolidated net income of £1,276,067 (£1,317,637).

Dowding and Mills

Profit for the year ended 30 June last, before tax, is £149,366 (£141,398), and a final dividend of 3d per 1s share again makes the total distribution 4½d.

Hailwood Industries Ltd.

Dividend for the year to 30 June last of this lighting glassware firm is 15%, and the directors forecast at least maintenance of that rate for 1960-61 on capital increased by a one-for-two scrip issue. Group profit is £179,817 (£102,985), and after taxation, etc., net profit amounts to £95,093 (£54,221). In maintaining the 15% dividend, the directors state that they have been influenced by the substantial programme of expansion they have now approved, which will involve considerable expenditure.

Laurence Scott and Electromotors

Announcing a maintained interim dividend of 3d per 5s share for 1960, the directors again point out that competitive conditions have become increasingly severe and, moreover, that production has been adversely affected by certain contracts undertaken during the period of order scarcity. As a result, the profit level for the current year is likely to show a decrease on previous years. Nevertheless, it is expected that the previous year's final of 6d per share will be maintained. The volume of incoming orders received during 1960 is considered satisfactory, in view of prevailing trading conditions.

Longmore Brothers Ltd.

With profit increasing to £256,048 for the year to 4 Aug. last, the dividend is raised a further 5% to 30% for this conduit and tube firm. Profit for the previous year was £170,834 before tax. After taxation charge, the net profit becomes £127,548 (£87,434).

L. Sterne and Co. Ltd.

The redundancy news no doubt contributed to the poor result of this concern's "rights" issue of 762,528 Ordinary 5s shares. Only about 66% (502,995) of the shares were applied for.

Waite and Son

This lampshade firm has had a healthy increase in sales for the first nine months of 1960 compared with the previous year, and the chairman estimates that profits, before tax, for the year should be at least £50,000—sufficient to absorb the present debit balance on profit and loss account and enable the resumption of dividend payments.

Intended Dividends

Anglo-Portuguese Telegraph Co. Interim 3% (same).

Atlas Electric and General Trust. Interim 3% (against equivalent of 2%).

Bulpitts (Swan Brand). Interim 5% (same).

Edwards High Vacuum Ltd. Interim 5% (against equivalent of 4%).

Power Investment Corp'n. Interim 4% (same).

Pressed Steel Co. Interim 9% (same), but on larger capital.

Stone-Platt Industries. Interim 4½% (4%).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

3 Nov.—**Newcastle upon Tyne C.C.** (1) Electrical installation in further extensions and alterations at Heaton Grammar and High Schools.—See 27 Oct. issue.

3 Nov.—**Sunderland B.C.** Supply of gas and electric cooking equipment for Bede Grammar School.—See 27 Oct. issue.

4 Nov.—**Bristol C.C.** Electrical installation, on fixed-price basis, at new Redland Trng College, Redland Hill. Applications, by contractors on N.I.C.E.I.C. roll, for re-advertised tender, to City Architect, Council Hse, by above date.

4 Nov.—**Down C.C.** All-electric lighting and heating installation in Child Health and Welfare Clinic, Knockree Ave, Kilkeel.—See 13 Oct. issue.

4 Nov.—**Dunbarton C.C.** Supply of Group "B" tubular steel columns.—See 27 Oct. issue.

4 Nov.—**Oldbury B.C.** Erection, on fixed-price basis, of 88 Class "B" concrete columns, supply and fitting of post-top lanterns with lamps/control gear/time switches, plus resiting of 26 units and conversion to MBF/U operation along various roads.—See 20 Oct. issue.

4 Nov.—**Stornoway B.C.** Electrical work in erection of ten houses, Keith and Newton streets. Applications to architects: Gratton and McLean, 21 Woodside Terr, Glasgow, by above date.

5 Nov.—**East Anglian Hospital Board.** Applications for inclusion in list of approved contractors to Board's Engineer, Block "B," Government Bldgs, Brooklands Ave, Cambridge, by above date.—Advertised 27 Oct. issue.

5 Nov.—**Longbenton U.D.C.** Supply and erection of 64 sodium units and 474 post-top lantern filament Group II street lighting units.—See 20 Oct. issue.

5 Nov.—**New Windsor B.C.** Supply of (Item 15) lamps and (Item 21) fittings and cable for year to 31 Dec., 1961.—See 6 Oct. issue.

7 Nov.—**Aldershot B.C.** Supply and erection of Group "A" 25 ft steel columns with 140 W sodium lighting along Lower Farnham Rd and Group "B" 15 ft steel columns and 60 W sodium lighting along Church La West/Ayling Hill.—See 27 Oct. issue.

7 Nov.—**Baldon U.D.C.** Electrical work in 30 houses at The Grove. Housing Manager, Town Hall.

7 Nov.—**Belfast C.C.** Electrical work in alterations and renovation at Falls Rd Public Baths.—See 27 Oct. issue.

7 Nov.—**Bristol C.C.** (b) Electrical installation, on fixed-price basis, in primary school at Withywood. Applications to City Architect, Council Hse, by above date.

7 Nov.—**East Suffolk C.C.** Street lighting included in Contract No. 36 for making up of 247 yd private road.—See 27 Oct. issue.

7 Nov.—**Edinburgh** (2) Electrical services renewal in Ward 4 alterations at Northern General Hospital. Applications to consulting engineers: Hulley and Kirkwood, 5 Lynedoch St, Glasgow C3, by above date.

7 Nov.—**Manchester C.C.** Contract 323. Electrical installations: 12 flats, two shops and ten garages, Greenwood Rd.—Advertised 27 Oct. issue.

7 Nov.—**Swanage U.D.C.** Electrical installation in new depot at King's Rd-West.—See 20 Oct. issue.

8 Nov.—**Flintshire C.C.** Electrical installations on smallholdings: (a) Wood Farm; (b) Talwrn Scheme (3 holdings); (c) Shordley all at Kinnerton. County Land Agent, Maysmor W. Jones, 16 Wrexham St, Mold. Deposit £1 ls.

8 Nov.—**N.I. Hospitals Authority.** Supply

of two heated food conveyors. Purchasing Officer, Belfast Hospital Management Committee, Broadway.

9 Nov.—**Cheadle and Gatley U.D.C.** Supply and erection of 30 Group "A" pre-stressed concrete columns with 400 W mercury vapour lanterns in Bird Hall La.—See 27 Oct. issue.

9 Nov.—**Chelmsford B.C.** (c) Electrical installation in new livestock market, Victoria Rd.—See 27 Oct. issue.

9 Nov.—**Durham C.C.** Electrical installations in standard police houses at Darlington Rd, West Auckland and Low Grange Ave, Billingham. Applications to County Architect, South St, Durham, by above date.

9 Nov.—**Edinburgh** (2) Electrical works in conversions to form ante-natal clinic at Eastern General Hospital, Edinburgh 6. Applications to Ian Hunter and Ptnrs, 46 Palmerston Pl, Edinburgh 12.

10 Nov.—**Derby B.C.** Supply of 49 200 W sodium discharge units on 35 ft steel columns for A5111 Raynesway Trunk Rd lighting.—Advertised 27 Oct. issue.

10 Nov.—**Northwich R.D.C.** Supply and installation of 40 Group "A" concrete columns with sodium lamps/lanterns/gear.—See 20 Oct. issue.

10 Nov.—**Suffolk and Ipswich Fire Authority.** Electrical work at Colchester Rd Fire Station.—Advertised 27 Oct. issue.

10 Nov.—**Sunderland B.C.** Electrical installation in sports pavilion, Marley Pots. Borough Architect, Grange Hse, Stockton Rd.

11 Nov.—**Essex C.C.** Supply and erection of 11 35 ft tubular steel columns with 200 W linear sodium lamps/gear on A11 roundabout at Stump Cross. County Surveyor, Highways Dept., Old Court, Chelmsford.

11 Nov.—**Horsham U.D.C.** Supply and erection of 26 Stanton Group "B" concrete columns and G.E.C. post-top lanterns for Hawkesbourne Rd and Redkilm Way lighting. Applications to Council Surveyor, Council Offices, Horsham Pk, by above date.

11 Nov.—**New Windsor.** Electrical installations in two maisonnettes at Clewer New Town.—See 13 Oct. issue.

11 Nov.—**Oldbury B.C.** Erection, on fixed-price basis, of 20 Class "B" concrete columns, supply and fitting of post-top lanterns/lamps, control gear/time switches on Lion Farm estate.—See 20 Oct. issue.

11 Nov.—**Wrexham B.C.** Supply and erection, on fixed-price basis, of ten 25 ft fluted steel columns/brackets and 140 W sodium vapour lanterns/lamps for A483 (part) lighting.—Advertised 27 Oct. issue.

14 Nov.—**Malvern U.D.C.** Erection of 151 concrete columns and lanterns plus provision

of wiring/lamps on seven new estates together with the removal of four gas lighting columns.—See 27 Oct. issue.

14 Nov.—**N.A.T.O. Infrastructure.** Provision and proving of a very low-frequency radio-telegraph transmitting station in North of England.—Advertised 13 Oct. issue.

14 Nov.—**West Riding C.C.** Changeover from d.c. to a.c., by contractors on N.I.C.E.I.C. roll, at Beech Towers, Staincliffe, Dewsbury.—See 27 Oct. issue.

15 Nov.—**Rayleigh U.D.C.** Supply and erection of 14 Group "A" concrete columns and 28 sodium lamps/gear for A127 Southend Arterial Rd lighting. Engineer and Surveyor, Council Offices.

15 Nov.—**Whaley Bridge U.D.C.** Supply and erection complete of 16 Class "A" concrete columns with sodium lighting.—See 27 Oct. issue.

16 Nov.—**Ipswich B.C.** Electrical installation in proposed 56-person aged people's home, Chantry estate.—See 20 Oct. issue.

16 Nov.—**Wigan B.C.** Electrical installations in 27 dwellings on Drummond Sq site. Borough Engineer, Hewlett St. Deposit £1 ls.

17 Nov.—**Belfast C.C.** Electrical installation in Assembly Hall, Dunkeld Gdns Model Secondary School for Girls.—See 27 Oct. issue.

17 Nov.—**Birmingham C.C.** Socket-outlet installations and lighting installation repairs in 250 houses at Acock's Green.—See 20 Oct. issue.

17 Nov.—**Darfield U.D.C.** Rewiring of 118 houses. Surveyor and Public Health Inspector, Council Offices, Darfield, near Barnsley.

17 Nov.—**Fylde Water Board.** Supply of flow recorder panel and hydraulic measuring equipment.—Advertised 13 Oct. issue.

17 Nov.—**Glasgow T.C.** Supply of heavy catering equipment for school kitchens including: (Item 7) fish fryer; (8) refrigerators; (9) food preparing machine; (10) hot cupboard; (11) potato peeling machine; (12) mixing machine; (13) meat slicer. City Architect, Education Section, 20 Tronagate, Glasgow C.1.

18 Nov.—**Hornchurch U.D.C.** Class "A" lighting for Trunk Rd A13; resiting of 30 steel units and erection of 34 steel units; (2) supply of 34 steel columns; (3) supply of 83 lanterns; (4) supply of 83 sets control gear; (5) supply of 83 horizontal 400 W MBF/U lamps. Engineer and Surveyor, Council Offices, Billet La. Deposit £2 2s.

19 Nov.—**Flintshire C.C.** Compressor for charging B.A. cylinders. Chief Fire Officer, Coast Rd, Rhyl.

21 Nov.—**Morpeth R.D.C.** Electrical installations in 18 houses, Mitford. Engineer and

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 108 queries answered this week

"Lectross" towel and clothes dryers—address for spares? M.A.N.W.E.B.—Electronic Precision Equipment Ltd., 46 Windmill Hill, Ruislip, Middx.

"Behr" convector heaters—agents for? E.E.—Joseph Lang and Co., 148 Fleet Rd, N.W.3.

"Vogue" washing machines—agents for? S.W.E.B.—Metalcraft Mnfgr. Co. (Canada) Ltd., 37 Berners St, W.1.

"Twinnyvac" vacuum cleaners—agents for? L.E.B.—F. Horn, 55 Park La, W.1.

"Mastermatic" vending machines—makers of? V.C.—The Master Vending

Machine Co. Ltd., 175 High St, Deritend, Birmingham 12.

"Veto" fluorescent lamps—agents for? R.B.—Deta (Overseas) Co. Ltd., 31 Moscow Rd, Caroline Pl, W.2.

"Rota-Plan" light diffuser—makers of? J.T.C.—Rotaflex (G.B.) Ltd., 4 Nile St, N.1.

"Cleanmaster" vacuum cleaners—repairers of? E.S.—Electrix Ltd., Sterling Wks, Dagenham, Essex.

"Dee Gee" egg boilers—makers of? C.J.B.—David Griffin Ltd., 39 Wimborne Rd, Poole, Dorset.

J. R. Miles, Council Offices,

-**Musselburgh B.C.** Supply and fit 66 15 ft and 15 25 ft concrete and installation of mercury and lighting in various roads. Burgh Municipal Offices.

-**Dublin.** Electrical installation in pathological laboratory and mortuary at Sir Patrick Dun's Hospitals from consulting engineers: 98 St. Stephen's Gn, Dublin. 10.

-**Middlesex C.C.** Contract Sub. 39. Lighting and heating of power house and Sewage Wks. N.9, by contract with d.c. experience. Contract supply of miscellaneous plant and attic telephone exchange. Details by consulting engineers: J. D. and D. M. 67 Tufton St, S.W.1. Deposit made payable to the consultants.—in this issue.

-**Manchester C.C.** Electrical installation at Harpurhey Technical High School. City Architect, P.O. Box 488, 1.

-**Aberdeen C.C.** Supply of lamps and Superintending of Lighting, 262. Advertised in this issue.

-**Tottenham B.C.** Supply of (Item 3) year.—See 27 Oct. issue.

-**Braintree and Bocking U.D.C.** (1) of 112 Group "B" prestressed concrete; (2) supply, erection and 115 45/60 W sodium lanterns; cable ducts; (4) dismantling existing; (5) incidental works. Enl Surveyor, Town Hall, Braintree. 2 2s.—Advertised in this issue.

-**Highwell U.D.C.** (i) Supply of (a) columns and (b) lanterns/lamps; and installation of 21 200 W units for A11 No. 2 lighting scheme. Enl Surveyor, Council Offices, Old 4, Loughton. Deposit £2 2s.

-**Manchester C.C.** Supply and installation of existing aeration at Davyhulme Sewage Wks. City Town Hall, Manchester 2.—Advertised in this issue.

-**Stockport B.C.** 2. Electrical installation of Welfare Clinic, Longford Reddish. Documents, available from Borough Architect, Town

13 Dec.—**Kirkcaldy T.C.** (b) Electrical work in erection of new hall at Links St. Details from quantity surveyor: G. Cubbage, 203 High St, Kirkcaldy.

14 Dec.—**Matlock U.D.C.** Supply and installation complete of nine sewage pumps at four pumping stations in Darley Vale.—See 6 Oct. issue.

No date stated—**N. of Scotland H.E.B.** 60 MVA transformer for Persley substation, Aberdeen.—Advertised 13 Oct. issue.

No date stated—**St. Faith's and Aylsham R.D.C.** Supply of columns, lanterns, lamps and auxiliary equipment.—See 13 Oct. issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

11 Nov.—**India.** L.T. insulators. Superintending Engineer (Proc.), Rajasthan State E.B., Power Hse, Jaipur. B.O.T. (ESB/27850/60).*

11 Nov.—**Pakistan.** 36,000 lb l.t. bitumen compound; 4,000 lb plastics compound; l.t. pin and shackle insulators. Director of Stores, W.A.P.D.A., Gardee Trust Bldg, Old Anarkali, Lahore. B.O.T. (ESB/28200 and 28291/60).*

14 Nov.—**America.** Three items disconnect horn gap switches and disconnect fuses. Dept. of Interior, Bureau of Reclamation, C. S. Shisler, Contract Purchase Unit, Bldg 53, Denver Federal Center, Colorado. B.O.T. (ESB/28199/60).*

14 Nov.—**Burma.** 5, 10 and 15 A three-pin plugs/sockets, tumbler switches and 9 in. Coolicon shades. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.O.T. (ESB/27864/60).*

14 Nov.—**India.** 35,000 yd l.t. and h.t. p.i.l.c.d.s.t.a. cable. General Manager, Delhi E.S.U., Rajghat, P.O. Box 589. B.O.T. (ESB/27666/60).*

14 Nov.—**India.** 132 kV transmission line conductors and accessories. Superintending Engineer (Projects), Madhya Pradesh Electricity Board, Jabalpur. B.O.T. (ESB/27619/60).*

15 Nov.—**America.** Ten items wire and cable including control cable and wire.

Dept. of the Interior, Bonneville Power Administration, 1001 N.E. Lloyd Boulevard, Portland, Oregon. B.O.T. (ESB/28475/60).*

15 Nov.—**America.** Seven 1,500 kW diesel engine generating sets. U.S. Army Engineer District, Mobile Corps of Engineers, Bldg 3, 2301 Grant St, Mobile, Alabama. B.O.T. (ESB/28483/60).*

15 Nov.—**Pakistan.** 14 items accessories including lampholders, switches, plugs and sockets. Director of Stores, Electricity, Water and Power Development Authority, Gardi Trust Bldg, Old Anarkali, Lahore. B.O.T. (ESB/28167/60).*

16 Nov.—**Australia.** Ten mile 2.2 kV 0-03 twin core, wire armoured lead sheathed cable. Secretary, Victorian Railway, Spencer St, Melbourne C.1. B.O.T. (ESB/28112/60).*

16 Nov.—**Australia.** 230 kV transformers for Terang terminal station. 72,000 10 in. disc insulators. State E.C. of Victoria, William St, Melbourne. B.O.T. (ESB/28170 and 1/60).*

16 Nov.—**New Zealand.** Overhead travelling crane. Town Clerk, P.O. Box 2199, Wellington C.1. B.O.T. (ESB/28459/60).*

16 Nov.—**Pakistan.** 24 motor driven pumping sets. Deputy Director-General, Industries, Trade and Supply, P.I.D.C. Hse, Motijheel, Dacca. B.O.T. (ESB/27884/60).*

17 Nov.—**America.** Load-frequency control set for Watertown power system operations office and telemetering equipment for Rainbow substation. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center, Colorado. B.O.T. (ESB/28114/60).*

18 Nov.—**S. Africa.** Armoured underground telephone cable and accessories for S.A. Railways. Chairman, Tender Board, P.O. Box 7784, Johannesburg. B.O.T. (ESB/27633/60).*

21 Nov.—**Australia.** Two 53-cell 3,000 Ah Planté type batteries, two 4-cell 200 Ah batteries and chargers. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.O.T. (ESB/28148/60).*

22 Nov.—**America.** Two 55,555 kVA 13.8 kV vertical shaft alternators for Trinity Power Plant. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.O.T. (ESB/27664/60).*

23 Nov.—**Pakistan.** Lighting fixtures and refrigerators. Director of Supply, East Pakistan, P.I.D.C. Hse, Motijheel, Dacca. B.O.T. (ESB/28139/60).*

8 Dec.—**Sudan.** Six items p.i.l.c. telephone cable. Controller of Stores and Workshops, Dept. of Posts and Telegraphs, Light Industrial Area, Khartoum South. B.O.T. (ESB/27625/60).*

14 Dec.—**India.** Two 50 kW short-wave radio transmitters. Tender reference SE 4/3972-L/111-A, fee 15s, from Directorate-General of Supplies and Disposals, N.I.C. Bldg, Parliament St, New Delhi.

15 Feb.—**India.** Railway 25 kV o/h equipment for (i) Sealdah to Ranaghat (250 km); (ii) Dum Dum Junction to Bongaon (80 km). General Manager and Chief Engineer, Railway Electrification, 235 Lower Circular Rd, Calcutta 20. B.O.T. (ESB/28103/60).*

CONTRACTS PLACED

-**ham Hospital Board.** (a) Rewiring (b) o.c.b.'s for Lea Castle Hosnsgrove; (a) Whittaker Bros. Ltd., 10 Midlands E.B., £1,415. Birmingham and Midland Eye Dale Electric Contractors (Birmingham), £17,191. Electrical services to Lucy Baldwin Maternity Hospital and Domestic Lighting and Ltd., £1,975. Recommended.

-**ham B.C.** Electrical installations in 100 St redevelopment dwellings, 100 St. E.B., £15,993.

-**C.C.** Road heating for approach to garage, Yorkshire E.B., £1,425. work in 252 maisonnettes on three G. Bailey and Co. Ltd., £26,160. 100 St.

-**D.C.** Supply and erection of 130 nns complete with 60 W sodium 100 St. Abacus Municipal Ltd.

-**ft B.C.** Electrical installations in 100 St. estate houses, Hughes (Lowestoft) 100 St. Recommended.

-**ster C.C.** Electrical installations 100 St. vellings, Partington, F. L. Bampton 100 St. and maisonnettes, Lomond Rd, 100 St. B. French Ltd.; Victoria Pk School, S. Dickinson Ltd.; 100 St. Lange Grammar School for Girls, 100 St. and Co. (Manchester) Ltd.; St. 100 St. Primary School, F. L. Bampton

-**100 St. Regional Hospital Board.** Elec- 100 St. tification in alterations and additions

to Winterton Hospital, Sedgfield, James Scott and Co., £1,873.

-**Newcastle upon Tyne C.C.** Lighting improvements at Whickham View School, Dougal and Railton Ltd., £3,237. Recommended.

-**Oxfordshire C.C.** Supply and erection of five 25 ft and seven 35 ft steel columns with 140 W and 200 W sodium lighting, Abacus Municipal Ltd.

-**Surrey C.C.** Rewiring of St. Nicholas Boarding School, Buchanan and Curwen Ltd., £1,120.

TRADE NOTES

Change of address. The Research and Development Division of Cawtell Research and Electronics Ltd. is now at 99 Uxbridge Rd, Ealing, W.5. Telephone: Ealing 7585.

The Automotive, Aircraft and Stationary Batteries Sales Divisions of Pritchett and Gold and E.P.S. Co. Ltd. have this week moved to the company headquarters at Dagenham Dock, Essex, where a new two-storey block has been built.

London office. S.R.O. Bearing Co. (Sales) Ltd., the recently formed British sales organisation of SRO Ball Bearing Works, Schmid-Roost Ltd., have now opened premises at 164 Camberwell Rd, S.E.5. Telephone: Rodney 6222.

New depot. A.E.I. Lamp and Lighting Co. Ltd. are opening a new Croydon depot at 111-113 Stafford Rd, Wallington, Surrey, on 7 Nov. The telephone No. is Franklin 1141.

Agencies. Erskine, Heap and Co. Ltd. after closing the agency arrangements with S. T. Pemberton and Co. Ltd. by mutual consent, have appointed their own technical sales engineer, Mr P. H. Baggott, of 55 Copthall Rd, Handsworth, Birmingham 21, to take charge of sales activities in the Midlands area.

Pyrotex Ltd. announces that their Bulawayan agents, Founders Electric Ltd., of Bulawayo, have now been appointed to handle Pyrotex m.i.c.c. cable for the whole of Southern Rhodesia.

BUSINESS PROSPECTS

Aldershot B.C. Tender: 116 Heron Wood estate houses, "Homeville" type. Engineer.

Atcham R.D.C. Tender: Eight flats in two blocks, Cross Houses. Engineer and Surveyor.

Basingstoke. Montgomerie Reid Engineering Co. plan extensions to Cufaude La, Bramley, works.

Bedford. W. H. Allen, Sons and Co. plan research laboratory, Bedfordham. Quantity Surveyors: A. L. Currie and Brown, 32 Clarendon Rd, Watford.

Birkenhead. Liverpool Regional Hospital Board, Pearl Ass. Hse, Castle St, Liverpool 2, to adapt premises for use as hospital.—Roslyn St premises planned by Stylewear Manufacturing Co., 515 New Chester Rd.

Birmingham T.C. Tender: Contract 700: Eight two-storey dwellings, Hay Mills; Contract 726: four shops and five dwellings, Longbridge; and Contract 713: 34 dwellings, Acoc's Green. Architect.

Brandon. Tonay Ltd., Durham Rd, Esh Winning, plan factory, offices and canteen.

Bristol. The Bristol Royal Workshops for the Blind plan extending the engineering department at £20,000 cost.—Pinchin Johnson and Assoc., 21 High St, plan warehouse on Bristolton trading estate.—Archie Allen Motor Cycles plan building on site of 111-115 St. George's Rd.—Parcar Ltd. of London plan multi-storey car park at Princes St and Narrow Quay.

Bromley B.C. Tender: 104 Turpington La flats. Engineer.

Burton upon Trent. £2,700 rewiring of Union St premises of the Technical College planned.

Cambridge. Howell, Killick and Partidge, 4 Fitzroy Sq, W.1, architects for University's science library.

Cardiff. Minags Investments to develop sites of 45-53 The Hayes for shops and offices.

Carlisle. Samuel Jaspers Ltd. and John Collier to reconstruct shop premises in English St.—T.C. plans conversion of Crosby Aerodrome into civic airport. Engineer.

Cheltenham. Homan and Rodger, St. George's Rd, plan 6,840 sq ft Tewkesbury Rd industrial building.

Cobham. Gotch and Ptnrs, 8 City Rd, E.C.1, architects for shops and maisonnettes for National Mutual Life Assurance Society, 39 King St, E.C.2.

Colne. Visi-Chick Brooder Co., Bradford Mill, plan £30,000 factory extensions.—Neilson Ice Cream and Frozen Food Co., Broad St, Nelson, Lancs, plan £100,000 distribution depot on White Walls estate.

Co. Wexford, Eire. £1 million extension scheme planned for superphosphate production by Albatross-Windmill Fertiliser Co., New Ross, Co. Wexford. Architect: D. O'Neill Flanagan, 12 O'Connell St, Waterford.

Croydon B.C. Tender: 234 dwellings as Stage 4 of Shrublands housing estate redevelopment. Engineer.

Dartford B.C. Tender: Four blocks of flats totalling 33 units with shops and garages. Clerk.

Don Valley. Divisional Education Executive plans new junior mixed and infants' school at Armthorpe. Executive's Clerk, Doncaster.

Dumfriesshire. E.C. approves layout of Annan Academy. Cost £400,000.

Durham T.C. Tender: 48 dwellings, Newton Hall estate. Engineer.

Erith. Barnes, Challen and Cross, 74 Gloucester Pl, W.1, architects for £15,000 Submarine Cables Ltd. extensions.

Gillingham B.C. Tender: 20 houses—Stage III of Stratford estate—Henley Close, Rainham. Engineer.

Glasgow T.C. Tender: College of Further Education, Langside, Glasgow S.2. Architects: Boissevain and Osmond, 2 Clairmont Gdns.

Glenrothes. 34,000 sq ft extensions to factory planned by Beckman Instruments, Queensway industrial estate. Architect: Peter Tinto, Woodside, Glenrothes.

Gosforth. Newcastle Hospital Board, Benfield Rd, Newcastle, plans out-patients' dept. at W. J. Sanderson Orthopaedic Hospital.

Greatham. Cerebos Ltd., Greatham, plan factory extensions. Architect: L. Auton, Regent Bldgs, York St, West Hartlepool.

Grimsby. Immingham factory planned by D. Byford and Co., Rotherham Rd, Maltby.—R.D.C. Further Fairway Estate and Immingham houses planned. Surveyor.

Halesowen B.C. Tender: 27 flats and maisonnettes at Bath Meadow, Belle Vale. Architects: A. T. Butler and Ptnrs, 31 Priory St, Dudley.

Hartlepool T.C. Three blocks of eight-storey flats planned providing 144 units of accommodation in Sea View Terr area. Engineer.

Hastings B.C. Traffic signals planned for junction of White Rock and Robertson St. Cost: £4,750.

Haverfordwest. A. and E. Arnold and Co., Marsh Yard, plan Johnston factory.

Hayes. G. H. Pike, 14 Lincoln's Inn Fields, architects for Dr Triplett's C.E. School at £55,000.

Heston and Isleworth. W. E. and E. M. Cross, The Studio, Osterley Rd, architects for Read Manufacturing Co.'s two-storey factory extensions, Springwell Rd.—B.C. Tender: Burnham Gdns, Cranford branch library. Surveyor.

Holland C.C. £249,650 new College of Further Education planned at Boston. Architect.

Jarrow T.C. Four shops and maisonnettes planned at Fellgate Ave, Boldon Colliery.

Kingston upon Thames. £35,000 factory planned for Delta Technical Services, Delta Wks, Cowleaze Rd, Kingston.

Lanark. James Macfarlane and Co. (Pollockshaws) plan £12,000 factory, High-bury Ave.

Liverpool. Duttons Ltd., 34 Pall Mall, Liverpool 3, plan new printing works.—Health Committee plans hostel for aged persons in Westminster Rd.

London. National Sea Training Schools, 146 Minorities, E.C.3, plan new premises at St. Katherine's Dock, St. Katherine's Way, Stepney, E.—Verner Rees, Lawrence and Mitchell, 38 Holland Villa Rd, W.14, architects for extensions to Westfield College, N.W.3.—E. Alec Colman Group, 5 Hyde Park Gate, S.W.7, plan shop/office block at 40-48 High St, W.3, and premises on Gaumont Cinema site.—Sydney Clough, Son and Ptnrs, 39 Devonshire St, W.1, architects for multi-storey car park/showrooms/offices, Grosvenor Rd area, S.W.1.—Ian Fraser and Assoc., 15 Bedford St, W.C.2, architects for six-storey offices at Caxton St, S.W.1.—Calderhead and Scobie, 7 Friars Stile Rd, Richmond, Surrey, architects for 250-bedroom hotel at Norfolk Sq, Paddington, W.2.—Ardin and Brookes and Ptnrs, 129 Mounty St, W.1, architects for block of shops at 150-162 Edgware Rd, W.2.—J. Smith, 49 Goodge St, W.1, plans shops and flats at 91-97 Church St, N.W.8.—Summer and Derwent, 151-159 Queensway, W.2, architects for rebuilding of 94-98 Oxford St, W.1.—Clifford Culpin and Ptnrs, 39 Doughty St, W.C.1, architects for London and Overseas Students' centre, Portland Pl, W.1.

Luton B.C. Tender: £250,000 Central Library. Architect.

Manchester. Powell and Moya, 36 Gt. Smith St, S.W.1, architects for Hospital Board's Wythenshawe Hospital.

Market Harborough U.D.C. Two-storey extension to Council Offices planned. Surveyor.

Middlesbrough. Jordison and Co., Marton Rd, plan new works and offices, Longlands Rd.—B.C. Further stage of street lighting programme to cost £45,200.

Middlesex. E.C. plans 100-student hostel for Brunel College of Technology, Acton, W.3.—Also laboratory and workshop block at Willesden Technical College and stage one of Enfield Technical College extensions.

Newcastle. Municipal College of Commerce planned, and first instalment of Colleges of Art and Industrial Design. City Architects' Dept., 18 Cloth Market, Newcastle.—T.C. plans block "C" of new town hall at Barras Bridge and flats and maisonnettes in Napier St and Walker Rd.—C. Solomon, 30 St. Mary's Pl, architect for Master Builders' Federation's planned offices in North View and Elvet St.

Norwich. Chaplin and Burgoine, 4 Cathedral Close, plan offices, etc., Thorpe Rd.

Oldham B.C. Tender: 17 houses, 32 flats and two shops with living accommodation, Littlemoor La redevelopment. Quantity Surveyors: Cameron and Middleton, 21 Queen St.—Welfare Services Committee plans new £56,000 Holts estate home.

Oxford. St. Edward's School plans three boarding houses at Woodstock Rd.

Preston. Manchester Regional Hospital Board, Cheetwood Rd, Manchester, plan out-patients' department at Sharoe Green Hospital, Fulwood.

Pudsey. J. T. Bell and Sons (London), 128 Park La, W.1, promoters of scheme for parade of shops and five-storey flats, Church La.

Rawmarsh U.D.C. Tender: 24 pairs of houses and 13 pairs of bungalows, Monkwood No. 2 Estate. Engineer.

Redcar B.C. Tender: 492 dwellings, Lakes Neighbourhood unit. Architects: Frederick Gibberd, 19 The Rows, Stonecross, Harlow.

Redditch. Lodge Park Developments plan five shops, a supermarket and maisonnettes on site of picture house.

Romford. Fuller, Hall and Foulsham, 212 High Holborn, W.C.1, architects for Eastern Rd offices.

Rotherham. Pearl Assurance, High Holborn, W.C.1, plan block of shops with offices at Moorgate St.

Slough. Slough Estates plan 42 new small factories on trading estate.

Southport. M.T. Divisional Rd Engineer preparing trunk road lighting for main route to Southport through Scarisbrick.

South Shields. S. W. Milburn and Ptnrs, 9 Esplanade, Sunderland, architects for Newcastle Hospital Board's planned Ingham Infirmary extensions.—Meade Taylor and Wilson, 33 Lansdowne Rd, W.1, architects for hostel at Marine and Technical College for 90 students.

Stockport B.C. Class "A" lighting planned at Shaw Heath and conversion from gas in Reddish area. Costs: £1,527 and £41,299.

Stockton-on-Tees. J. T. Bell and Sons, Market St Chmbrs, Newcastle, plan housing developments at Harrowgate La area for 628 houses.

Sunderland. Newrick and Blackbell, 58 John St, architects for Camrex Paints' Hendon Rd laboratory.—E.C. plans additions to West Park College of Further Education. Borough Architect: H. C. Bishop, Grange Hse, Stockton Rd.

Surbiton. Hough Bros., 104 Roebuck Rd, plan factory extensions.

Swansea B.C. Tender: Pentrepoeth Rd, Morriston, branch library. Architect.

Swindon. Holland & Hannen and Cubitts (Gt. Britain), 1 Queen Anne's Gate, S.W.1, contractors for £34 million construction plant at Stratton St. Margaret for Pressed Steel Co.—G. Brown and Ptnrs, Baldwin St, Bristol, architects for site development at High St/Newport St for Shop Parades Ltd.

Tavistock R.D.C. Tender: 22 dwellings, Drakes Park, Bere Alston. Clerk.

Tonbridge. Sir William Holford and Ptnrs, 2a Angel Court, E.C.2, architects for extensions at Tonbridge School.

Tunbridge Wells B.C. Tender: 126 Sherwood estate dwellings. Surveyor.

Tynemouth. Whitehouse Primary School planned. Stage I to accommodate 360 pupils and Stage II another 200. Architects: J. G. Cowe and Son, Claremont Pl, Newcastle.

Prospects—Continued

Hford. Cope, Cooper and Co. plan y and offices, Holywell estate (Plot 7). **Westing Co.**, 83 Sidney Rd, plan y and offices, Holywell estate.—**Pitt and wood**, 16 Vale Rd, Bushey, plan fac-and offices at Greycaines industrial, Bushey Mill La.—**New Era Laundry** ove from King's Ave to Holywell rial estate.—£365,000 buildings planned hysics Group and D.S.I.R. M. of W. ects' dept., Abell Hse, John Islip St,

at Bromwich. Crystallised Confections tunnel Rd factory.—**Lavender**, Twenty-and Percy, 35 Waterloo Rd, Wolver- ion, architects for steel fabrication Kelvin Way, for Bromford Iron and Co.—**H. Holland**, 394 High St, West wich, architect for Harville Haw-'s industrial buildings and offices for eton Properties.

at Hartlepool. The Expanded Metal lan extensions.—**Bell and Spouse**, 10

Scarborough St, architects for addition to Brierton Boys' Secondary School and West Hartlepool Boys' Grammar School.

Westminster T.C. £300,000 modernisation of street lighting planned.

Whittlesley U.D.C. 87 houses, 16 flats and 12 bungalows planned in New Rd develop- ment. Surveyor.

Wisbech B.C. Tender: 50 Tinkers Drove area houses. Engineer, Church Terr.

Wolverhampton. Ministry of Health ap- proves in principle £300,000 scheme for five new old peoples' homes.—**B.C. Tender:** Home for aged persons and flatlets at Broadway, Bushbury. Engineer.

Worcester T.C. Tender: 171 Warndon estate traditional dwellings. Engineer and Surveyor.

Worthing. C. L. Bencard, 243 Acton La, N.W.10, plan laboratory and office at Clarendon Rd.

York. Governors of St. John's College plan Garden St and Heworth Croft hostels.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Auto-Chief. B800,221. Class 9. Control apparatus for automatically maintaining predetermined temperatures in cooking appliances. British Thermostat Co. Ltd., Teddington Wks, Windmill Rd, Sunbury-on-Thames.

Bluecon. 805,793. Class 9. Capacitors. Dubilier Condenser Co. (1925) Ltd., Ducon Wks, Victoria Rd, W.3.

Burgot Automatic Alarm. B802,989. Class 9. Burglar and fire alarms, etc. Burgot Alarms Ltd., 26 Westbourne Grove, W.2.

Caravelle. 806,574. Class 9. Electric irons, etc. S. D. Rand Ltd., 29 Beak St, Regent St, W.1.

Electrochord. B802,717. Class 9. Wireless receiving sets, etc. George Whitaker and Son Ltd., 5-6 Lorrimore Bldgs, Olney Rd, S.E.17.

Philetta. 806,250. Class 9. Semi-conducting devices, discharge tubes, radio, telephone, and sound-recording apparatus, etc. Philips Electrical Ltd., Century Hse, Shaftesbury Ave, W.C.2.

Pyromajor and Pyrominor. B802,240/1. Class 9. Apparatus for indicating and controlling temperature, etc. Sifam Electrical Instrument Co. Ltd., Leigh Court, Higher Lincombe Rd, Torquay.

Registrac. 806,350. Class 9. Apparatus, etc. Sargrove Electronics Ltd., Alexandra Rd, Hounslow, Middx.

Sensikator. 804,859. Class 9. Electronic apparatus, etc. Burndept Ltd., 681 Salisbury Hse, Finsbury Circus, and London Wall, E.C.2.

Shoorlock. B796,624. Class 11. Refrigerator cabinets, refrigerators, etc. General Motors Corp., West Grand Boulevard and Cass Ave, Detroit, Michigan, U.S.A.

Sigmatic. 805,180. Class 7 and 805,181. Class 9. Welding machines, etc. Union Carbide Corp., 30 East 42nd St, New York 17, N.Y., U.S.A.

Splendor. 805,532. Class 10. Heated blankets. Splendor England Ltd., 7c Lower Belgrave St, S.W.1.

Gazette Announcements

COMPANIES ACTS

electric Appliance Co. Ltd. Mr R. W. r, Brotherton Chmbrs, Westgate, 1, appointed liquidator at extra- rary general meeting on 20 Oct. for the se of voluntarily winding-up.

Products Ltd. Final meeting of ers to be held at 18 Hyde Gdns, ume, on 23 Nov., at 3 p.m., to ve the liquidator's accounts.

tric (Mnfg) Ltd. Meeting of creditors held at Houldsworth Hall, 90 Deans-Manchester 3, on 7 Nov., at 2.45 p.m.

Name-It Ltd. First meetings of creditors tributories to be held at Royal Bldg Floor), St. Andrew's Cross, Plymouth, Nov., at 11 and 11.30 a.m., respec-

e-Beam Lamp Ltd. Last day for re- g proofs for intended dividend: 11 to liquidator: W. H. Haigh, Somerset 17 Temple St, Birmingham 2.

Voluntary Liquidation

Electric Electrix (Kent) Ltd., 59a High Rochester, retailers of electrical nces.

statement of affairs shown to a recent ng of creditors disclosed liabilities 53, of which £10,652 was owing to creditors, against assets of £8,402.

company, which took over an existing ss, was registered in January, 1959, in issued capital of £1,000.

itors passed a resolution for the ntment of Mr H. C. Hedges, account- of Poppleton and Appleby, 4 Charter- Sq, E.C.1, as liquidator.

BANKRUPTCY ACTS

Receiving Orders

ydor. T. G. Davison, electrical dealer, g as Woolwich Vacuum Supplies, at rry Hall Close, Orpington. Receiving dated 17 Oct.

erpool. J. Jones, electrical dealer, g as Stanley Electric Supplies, of 574 t Rd, Liverpool. Receiving order 14 Oct.

cester. N. C. Ward, electrical appliance r, carrying on business as Newline hold Suppliers at 92 Pindar Rd, New Estate. Receiving order dated 20 Oct.

ester. I. M. Robinson, radio, television elctrical dealer, carrying on business obinson's Radio, TV and Electrical es, at 4 Down Hill, High St, Bagillt, formerly at 44 Castle St, Caerwrlle. Receiving order dated 20 Oct.

rk. M. W. Walsh, electrical dealer, of lgate Rd, York. Receiving order dated t.

pan. J. Ball, electrical contractor, for- carrying on business at 36 Crompton 'igan. Receiving order dated 24 Oct.

First Meeting and Public Examination

Slough. J. S. Sizmore, electrical retailer and contractor, of 12 Stoke Rd, Slough. First meeting: 11.30 a.m., 4 Nov., at 58-61 York Terr, Regent's Pk, N.W.1; and public examination: 11.30 a.m., 25 Jan., at Law Courts, Windsor Rd, Slough.

Appointment of Trustees

Durham. J. M. Hill, electrical, television, radio dealer, etc., carrying on business at 24 Station Rd, Ushaw Moor. Mr E. Taylor, 30-32 Grey St, Newcastle, appointed trustee as from 27 Sept.

Sheffield. J. W. Trickett, electrical domestic appliance dealer, carrying on business at 6 Turner La, Whiston, near Rotherham. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed trustee as from 26 Sept.

Birkenhead. G. Ford, fluorescent lighting specialist, carrying on business at 110a Brighton St, Wallasey. Mr C. A. Huntington, 41 North John St, Liverpool 2, appointed trustee as from 28 Sept.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

D. Alldridge and Sons Ltd., 13 Oxford St, Southampton. To take over business of electrical engineers and contractors carried on at Southampton by Douglas E. O. Alldridge, etc. Nom. cap.: £50,000. Dirs.: Douglas E. O. Alldridge, Hilda M. Alldridge, Douglas Alldridge, Junr., John Alldridge and Alwynne A. Thomas.

Bexelectric Ltd., 71 High St, Polegate, Sussex. Wholesalers, retailers, manufacturers of and dealers in dynamos, motors, arma- tures, etc. Nom. cap.: £100. Dirs.: Maurice W. Beck, Mrs R. G. Beck and Geo. N. Henty.

British Electrical Approvals Board for Domestic Appliances, 26-27 Cockspur St, S.W.1. Word "Limited" omitted from title by licence of the Board of Trade. The income and property of the Company, whencesoever derived, shall be applied solely towards the promotion of its objects. Management board include: W. J. Bird, J. I. Bernard, H. A. R. Binney, L. C. Penwill and P. B. Etheridge. Subs.: British Electrical and Allied Manufacturers Association, British Electrical Development Association, British Standards Institution, Electrical Contractors' Association and P. B. Etheridge (representing Electrical Whole- salers' Federation).

Chas. Cooke (Talgarth) Ltd., Wye Chmbrs, 24 Castle St, Hay-on-Wye. To carry on business of electricians, mechanical engi- neers, etc. Nom. cap.: £5,000. Dirs.: Wm. C. Cooke and Eileen G. Cooke.

S. N. Fordyce and Sons Ltd., Upper Richmond Rd West, S.W.4. Electricians, radio engineers, electrical engineers, etc. Nom. cap.: £4,000. Dirs.: Stewart N. Fordyce and Gladys B. Fordyce.

Glacial Refrigeration Ltd., 46 Mostyn St, Llandudno. Radio, television, electrical and electronic engineers, refrigeration engineers, etc. Nom. cap.: £5,000. Dirs.: Leslie G. Odd and Winifred M. Odd.

I.M.D. (Electrical Instruments) Ltd., 13 South Molton St, W.1. Nom. cap.: £2,000. Dir.: Anthony C. Cadwallader.

Instrumec Ltd., 52 Brown St, Manchester. Electronic and electrical engineers, etc. Nom. cap.: £1,000. Permanent dirs.: Walter Reedy, Norman C. Thomas and Jas. M. Blyth.

Ponteland Electricals Ltd. Nom. cap.: £5,000. Dirs.: Stanley F. Jours, 23 Customs Hse Chmbrs, Quayside, Newcastle-on-Tyne; and Aldo Costella, 48 Western Way, Darras Hall, Newcastle-on-Tyne.

A. D. Speed (Electrical) Ltd., 30 Portland Rd, Aldridge, Staffs. Nom. cap.: £2,000. Dirs.: Alfred D. Speed and Alma O. Speed.

Technic Electrics (B'ham) Ltd., 891 Per- shore Rd, Birmingham 29. Nom. cap.: £1,000. Dirs.: Albert W. G. Newbery, Wm. A. Newbery and Wm. K. Bryan.

Thompson and Holme Ltd., 28 Mackenzie St, Slough, Bucks. Electrical engineers, etc. Nom. cap.: £500. Dirs.: Wm. J. Thompson and John R. Holme.

L. W. Yeates (Electro-Heat) Ltd., 21 Star Rd, Caversham, Reading, Berks. Nom. Cap.: £2,000. Dirs.: Leslie W. Yeates and Leonard J. Ridgus.

MEETINGS TO NOTE

THURSDAY, 3 NOV.

I.E.E. (Joint meeting with Civils and Mechanicals). "The Training of Overseas Graduate Engineers, with Particular Reference to the F.B.I. Scholarships Scheme," W. Abbott. Savoy Pl, W.C.2. 5.30 p.m.

A.S.E.E. (Brighton, Hove). "Electrification of the Railways," T. R. Humes. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (E. Midlands). "Instrumentation in Biophysics," F. A. Glover. College of Further Education, Greenclose La, Loughborough. 7.15 p.m.

I.E.S. (Birmingham). Ladies' Night. Botanical Gdns, Edgbaston. 7.30 p.m.

I.E.S. (Glasgow). "Lighting for Ships," J. T. Grundy. Joint meeting with Institution of Engineers and Shipbuilders in Scotland. Weir Hall, 39 Elmbank Cres. 6.30 p.m.

I.E.S. (Nottingham). "Horticultural Lighting," A. W. Gray. Electricity Centre, Carrington St. 6 p.m.

FRIDAY, 4 NOV.

I.E.E. (Medical Electronics Group). Discussion: "Electro-Convulsive Therapy." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (N.E. Graduates and Students). "Aspects of Large Thermal Power Station Construction, Operation and Management," R. Lott. Grey Mall, King's College, Newcastle. 6.30 p.m.

A.S.E.E. (Liverpool). "Industrial Lighting," J. D. Ducker. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "The Development of Plastic Insulated Mains Cables, Jointing and Terminating," D. H. Booth. Royal Hotel, Crewe. 7.30 p.m.

A.S.E.E. (Wolverhampton and District). Dinner/dance at Star and Garter Hotel, Victoria St. 7.30 p.m.

N.E. ELECTRICAL CLUB ANNUAL DINNER, County Hotel, Newcastle upon Tyne.

INSTITUTION OF PLANT ENGINEERS (Kent). Branch Annual Dinner and Dance at Central Hotel, Gillingham.

A.P.L.E. (S. Western). Induction of chairman, followed by "Public Lighting Plan for Weston-super-Mare," J. R. Freer-Hewish, and "The Electricity Board's Part in Public Lighting," H. G. B. Dickinson. Town Hall, Weston-super-Mare. 2.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "Automation in the Post Office," W. S. Roddis. Admin. Bldg, Esso Refinery. 5.30 p.m.

SATURDAY, 5 NOV.

I.E.E., MECHANICALS AND CIVILS (London Graduates and Students). Joint dance, Carlton Rooms, Maids Vale, W.9. 7 p.m.

MONDAY, 7 NOV.

I.E.E. Discussion: "The Impact of Television on Society." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). "Water-Turbine Driven Induction Generators," C. L. C. Allan. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands). "A Survey of Street Lighting and Its Future," W. R. Stevens and H. M. Ferguson. James Watt Memorial Institute, Birmingham. 6.30 p.m.

I.E.E. (Scottish Electronics and Measurement Group). "Advances in Semiconductor Devices and Circuits," J. Evans and T. H. Walker. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

I.E.E. (Maidstone). "Subscriber Trunk Dialling," H. E. Francis. Maidstone Technical College. 7 p.m.

I.E.E. (Mersey and N. Wales). Annual dinner. Adelphi Hotel, Liverpool. 7 p.m.

N.E. ELECTRICAL CLUB. "Flameproof at Home and Abroad," M. J. Deering. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (N. Eastern). "Economic Distribution of Steam," J. A. Robbins. Newcastle. 6 p.m.

A.S.E.E. (Bolton). "Under-floor Cable Ducts," Railway Hotel, Trinity St. 7.45 p.m.

A.S.E.E. (Essex). "Electric Floor-warming," G. C. Peacock and G. E. East. Angel Hotel, Broadway, Ilford. 8.15 p.m.

A.S.E.E. (Leeds). "Metal Rectifiers," D. Magnall. Gt. Northern Hotel. 7.30 p.m.

A.S.E.E. (Sheffield). "Modern Lighting as Applied to all Phases of the Electrical Industry," V. L. Turp. Royal Victoria Hotel. 7.30 p.m.

TUESDAY, 8 NOV.

I.E.E. (Measurement and Control Section). Dinner. Café Royal. 7.30 p.m.

I.E.E. (Southern). "Error Correction in Digital Data Transmission System," J. E. Meggitt. The University, Southampton. 6.30 p.m.

I.E.E. (Mersey and N. Wales). "Submersible Pumping Plant," H. H. Anderson and W. G. Crawford. Joint meeting with the North Western Centre. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Midlands). Discussion: "City and Guilds or National Certificate?" College of Technology, Calverley St, Leeds. 6.30 p.m.

I.E.E. (N. Ireland). "The Application of Irradiation in Industry," M. C. Crowley-Milling. Civil Eng. Dept., David Keir Bldg, Queen's University, Belfast. 6.30 p.m.

I.E.E. (Scottish Electronics and Measurement Group). "Advances in Semiconductor Devices and Circuits," J. Evans and T. H. Walker. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (N.E. Graduates and Students). "Transistors—Their Operation and Application," K. W. Huddart. Sunderland Technical College. 6.30 p.m.

I.E.E. (N. Midlands Graduates and Students). "The Experimental Investigation of Space," P. J. Bowen. Gt. Northern Hotel, Wellington St, Leeds 1. 7 p.m.

INSTITUTION OF CIVIL ENGINEERS. "Some Contributions from Nuclear Power to Engineering Practice," I. Davidson. Gt. George St, S.W.1. 5.30 p.m.

I.E.S. "25 Years of Stage Lighting," F. P. Benthall. Federation of British Industries, Tothill St, S.W.1. 6 p.m.

A.S.E.E. (Aldershot and District). "Electrical Control," Dr W. L. Stern. Woking. 8 p.m.

A.S.E.E. (Chester and District). "The Protection of Electrical Installations," J. A. Robbins. Westminster Hotel, City Rd. 7.45 p.m.

A.S.E.E. (Newcastle-on-Tyne). "Temperature Controls," Roadway Hse, Oxford St. 7.30 p.m.

A.S.E.E. (S. Wales). "Fire Fighting and Prevention," C. N. Bidgood. Park Hotel, Park Pl, Cardiff. 7.30 p.m.

A.S.E.E. (York). "The Aims and Objects of the National Inspection Council," P. Laughton. Royal Station Hotel. 7.30 p.m.

BRITISH LIGHTING COUNCIL. Symposium on lighting at Building Centre, Portland St Manchester 1 until 9 Nov.

WEDNESDAY, 9 NOV.

I.E.E. (Southern). "The Design of Housing-Estate Distribution Systems Using a Digital Computer," R. L. Grimdale and P. M. Sinclair. S.E.B. Showrooms, 17 New Canal, Salisbury. 6.30 p.m.

I.E.E. (N.W. Electronics and Communications Group). "The Applications of Microwaves," Prof A. L. Cullen. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (Rugby). Annual dinner. Masonic Hall, Rugby. 7.30 p.m.

I.E.E. (S.W. Scotland). "The Digital Computer," I. Cochrane. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

I.E.E. (N. Lancs). "Some Aspects of Telephone Plant Protection in the Lancaster Area," L. Williams. N.W.E.B. Demonstration Theatre, Lancaster Rd, Lancaster. 7.15 p.m.

I.E.E. (Oxford). "Pumped Storage," V. G. Newman. S.E.B. District Office, 37 George St. 7 p.m.

I.E.E. (Sheffield Graduates and Students). "The Experimental Investigation of Space," P. J. Bowen. Sheffield University.

I.E.E. (S. Midlands Graduates and Students). "High Power Rectifiers," D. Finney. James Watt Memorial Institute, Birmingham. 6.30 p.m.

BRITISH NUCLEAR ENERGY CONFERENCE. Symposium: "Use of Secondary Surfaces for Heat Transfer With Clean Gases," Birdcage Walk, S.W.1, until 10 Nov.

INSTITUTION OF PLANT ENGINEERS (Leicester). "Industrial Power Generation," A. Wheatling or J. M. Berridge. Midland Hotel. 7.30 p.m.

WOMEN'S ENGINEERING SOCIETY. "Railway Modernisation and Electrification," E. C. Cookson and A. H. Emerson. "Hope House," 45 Gt. Peter St, S.W.1. 7 p.m.

NEWPORT AND DISTRICT ELECTRIC CLUB. "The Design and Jointing of Low Voltage Plastic Insulated Mains Cable," D. H. Booth. King's Head Hotel. 6.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (London Graduates). "Induction Heating," D. G. Jones. 10 Chesterfield St, W.1. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Data Processing Section). "A Shaft Position Digitiser Using Synchros," T. Roberts. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

I.E.S. (Manchester). Annual dinner. Café Royal, Peter St. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Medical and Biological Electronics Group). "Diagnostic Applications of Ultrasonics," T. G.

Brown, London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N. Eastern). "Distribution of Sound and Television by Wire," A. W. Mews. Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Rd, Newcastle upon Tyne. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (W. Midlands). "Modern Computer Techniques," K. C. Johnson. Wolverhampton College of Technology. 7.15 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scottish). "V.H.F. AM/FM Transistor Receivers," H. A. Heins. Dept. of Natural Philosophy, University, Drummond St, Edinburgh. 7 p.m.

A.S.E.E. (Birmingham). "Modern Light Sources and their Application," W. A. R. Stoyke. Birmingham Exchange and Engineering Centre, Stephenson Pl. 7.30 p.m.

A.S.E.E. (Luton). "The Aims of the Electrical Association for Women," Miss A. S. Lockhart. Luton College of Technology. Park Sq. 8.15 p.m.

THURSDAY, 10 NOV.

I.E.E. (Utilisation Section). "The Logomotor—A Cylindrical Brushless Variable-Speed Induction Motor," Professor F. C. Williams, E. R. Laithwaite, J. F. Eastham and L. S. Pigott. "Brushless Variable-Speed Induction Motors Using Phase Shift Control," Professor F. C. Williams, E. R. Laithwaite, J. F. Eastham and W. Farrer. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (W. Wales). "The Shielding of Overhead Lines Against Lightning," J. H. Gridley. Conference Room, S. Wales Electricity Board, The Kingsway, Swansea. 6 p.m.

INSTITUTION OF CIVIL ENGINEERS. Discussion: "The Economics of Airports for Major Construction," Gt. George St, S.W.1. 5.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (N. Midlands). "Machine Tool Control," C. J. Charnley. Queen's Hall, Grand Hotel, Leicester. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). "Some Recent Advances in Radiation Pyrometry," B. W. Barley. M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scottish). V.H.F. AM/FM Transistor Receivers," H. A. Heins. Institution of Engineers and Shipbuilders, Elmbank Cres, Glasgow. 7 p.m.

A.S.E.E. (Bradford and District). "Power Transformers," J. Bennett. Midland Hotel. 7.30 p.m.

A.S.E.E. (S.W. London). "Under-floor Heating," L. Bishop; and "Maintenance of an Electro-plant Plant," B. Mitchison. Prince of Wales Hotel, S.W.19. 8.30 p.m.

FRIDAY, 11 NOV.

I.E.E. Joint meeting with Royal Aeronautical Society. "The Future of 'Electrics' and 'Electronics' in Aircraft and Guided Missiles," The Rt Hon The Viscount Caldecote. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Teesside). Annual dinner and Remin. Zealand Hotel, Saltburn-by-the-Sea. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. "Railway Signalling Problems in a.c. Traction Areas," H. J. N. Riddle. Peppys Hse, 14 Rochester Row, S.W.1. 7 p.m.

E.P.E.A. (Meter Engineers' Technical Group). Discussion: "Prepayment Methods," Canton Hall, Westminster, S.W.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Midlands). "The Common-sense Approach to Instrument Manufacture," C. E. T. Cridland. Lecture Theatre of the Byng Kendrick Suite, at the Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

E.I.B.A. BALL at Grosvenor Hse, at 7 p.m.

MONDAY, 14 NOV.

I.E.E. (Electronics and Communications Section). Discussion: "Tunnel-Diode Application and Circuitry," Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). "Teaching and Learning Machines," C. E. G. Bailey. Joint meeting with the North Western Association of the Institution of Civil Engineers. Town Hall, Chester. 6.30 p.m.

I.E.E. (Western). "The Measurement Basis Electricity Supply Metering," J. W. Skinner. South Wales Institute of Engineers, Cardiff. 6 p.m.

I.E.E. (N.E. Measurement and Electronics). "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. Setterington. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (E. Anglia). "The Oral Presentation Scientific Material," A. Clow. Technical College, Cambridge. 6.30 p.m.

I.E.E. (S. Midlands Supply and Utilisation Group). "Some Considerations in the Application of Power Rectifiers and Converters," J. McBreen. College of Technology, Gosta Green, Birmingham. 6 p.m.

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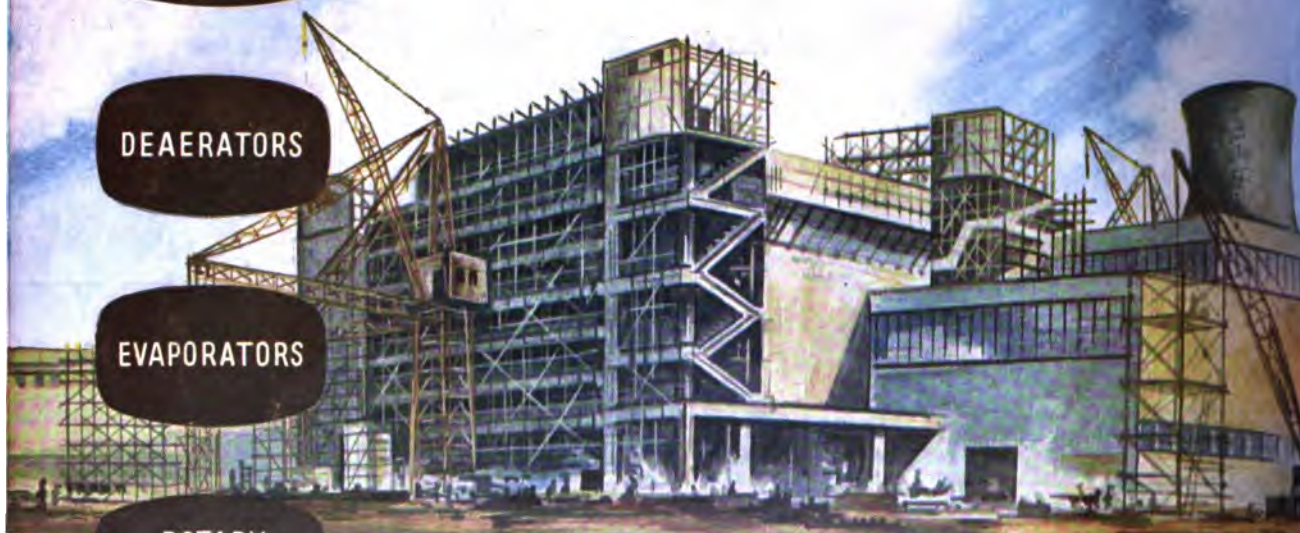
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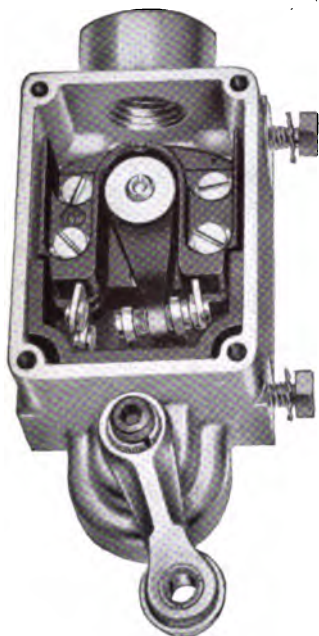
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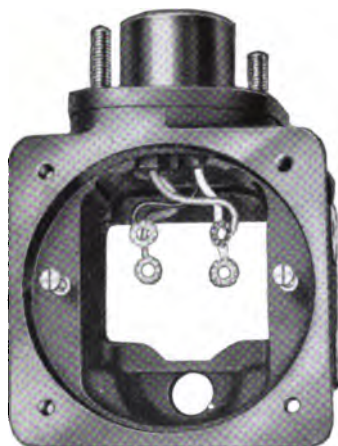
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e pour Moteur type Marin lère Partie ... 715
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 iner d'une manière satisfaisante lorsqu'ils sont
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 à l'usage à terre. Le débit mécanique est
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l d'Eclairage pour Théâtre ... 719
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 oles principales de l'Allemagne, de la Grande
 e et des Etats-Unis est en ce moment à l'étude.

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lisierungsvorschläge auf schalttechnischem
biet ... 709
 Senkung der Gestehungskosten der üblichen
 lagen wäre dadurch zu erreichen, dass die
 cher im Einvernehmen mit den Herstellerfirmen
 verzichten, Abweichungen von der im Grunde
 chen Ausschalterbauart zu verlangen. Würden
 rossabnehmer wie z.B. die Stromversorgungs-
 in dahingehend einigen, ihre individuellen An-
 igen einzuschränken, könnten Lieferungen infolge
 beitsvereinfachung im Konstruktionsbüro auch
 r durchgeführt werden. Weitere Einsparungen
 sich durch Verringerung der Anzahl der herges-
 Typen von Zubehöerteilen wie z.B. Einführungs-
 erzielen.

tilfsmotorensteuerungen, I ... 715
 teuerung eines Schiffswechselstrommotors soll mit
 Reihentrennschalter ausgerüstet sein und Schützen
 an, die auch in geneigter Lage verlässlich
 hen. Hierzu ist es in der Regel erforderlich,
 he Abziehfeder einzubauen. Obwohl eine nur
 mechanische Beanspruchung zu gewärtigen ist,
 Kontakteinrichtung so beschaffen sein, dass keine
 eissungsgefahr besteht.

eleuchtungs-Einrichtungen ... 719
 der Bühnenbeleuchtung sind Steuerungs- und
 tungstechniken gleichermaßen beteiligt. Entwick-
 auf dem Gebiete der Steuerungstechnik, die zur
 ung der durch den modernen Theater- und
 etrieb entstanden sind, haben bisweilen die
 ar eigentlichen Beleuchtungskörper in den Hinter-
 gedrängt, obwohl die von der Regie erstrehten
 ekte letzten Endes hiervon abhängig sind. Die in
 denen Ländern angewandten technischen Lösungen
 starke Unterschiede auf und die in den letzten
 ren entsprechend den drei Hauptstrichungen in
 land, England und den Ved. Staaten von Amerika
 telten Systeme werden miteinander verglichen.

ELECTRICAL
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News Editor:

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Comment

SAVING SWITCHING COSTS

Switchgear at heart consists of the circuit-breaker; for control gear it is the contactor. But when it comes to manufacture many auxiliary devices ranging from operating mechanisms to cable glands complicate such simplicity and multiply the number of designs that leave the factory. Users have their own ideas of what they want in such auxiliary details, and if they are controlling the placing of a contract worth some hundreds of thousands of pounds, as is common enough, they are likely to find manufacturers disinclined to argue. Yet the interests of the users as well as that of the manufacturers would be better met by accepting some limitation of choice. Drawing office and assembly time are much extended by the need to meet individual requirements, and the danger of errors in assembly and of subsequent expensive rectification is increased when each job going through the shops is one-off, or nearly so; and in the long run it will be the customers who pay. An article this week draws attention to this question in respect of switchgear and gives some idea of what may be achieved by standardisation and its modern extension, variety reduction. Co-operation with some large customers—one electricity board is mentioned especially—has secured valuable savings by way of agreement on basic layout for the more commonly required arrangements of auxiliaries with specific switches. Where there is a single customer, or a well-organised group of industrial users, more attention than at present should be given to agreeing such details. One does not have to go far at present to see, say, control gear ordered by different offices of the same organisation for the same task being built with radically different arrangements, for all it incorporates the same contactor. That is unnecessarily expensive. To set it right is an administrative effort likely to pay off in cash saving.

WEIGHTS AND MEASURES BY ORDER

Metric measurements become the overlords of traditional English units under the Weights and Measures Bill which is now before Parliament. All the fundamental definitions of Imperial system units will in future depend on the international definition of the metre and the kilogram. The time-honoured "Mr Baily's Metal No. 1" standard yard of 1845 is due to become liable to a four-decimal-place check from the international determination of the metre, in terms of the wavelength of light emitted by Krypton 86: pound and kilogram will be firmly linked. That will be welcomed by precision engineers, who have been working to limits too fine readily to accept the uncertainties of a standard based on a physical

object. And the highly complex Bill, with no less than 55 pages of schedules in a total length of 106 pages, goes further than that in rationalising the scientific aspects of measurement. Amp, ohm, volt and watt are brought into its ambit, with a requirement that the Board of Trade shall draw up definitions reflecting the international definitions for those units. Basic to these changes is to be the establishment of a nine-man Commission on Units of Standards and Measurement, which will keep the question of definition of units and of physical standards under review. Recommendations of this Commission will be given effect through the relatively simple process of the Statutory Instrument, subject to specific approval by Parliament in each case—though the right to abolish the Imperial system and go wholeheartedly metric by this route is specifically withheld. Although the provisions of the Bill about everyday measures and the information to be given to customers will be most in the public eye, the changes in fundamentals are important on the borderline of science and industry.

INVESTMENT IN SUPPLY

The first of the promised annual autumn White Papers on investment in the public sector, which we noticed briefly last week, proved to add little to what was already known about electricity supply plans. The significance of the overall study the White Paper presents is centred more on broad national financial policy than on individual industry details, but it is noticeable that the supply industry is being given freedom to expand and that there is recognition again of the needs of distribution as well as generation. It is reassuring to see endorsed in this Treasury document the truism that "once work has begun on a project it is usually uneconomic to attempt either to accelerate or retard it as an instrument of general economic policy." This has been well demonstrated in the past history of electricity supply, and it must be hoped that the dictum will be kept to the fore of Treasury thinking if the future should become difficult.

GOOD INTENTIONS

Reports on consumer goods published in *Which?*, the magazine of Consumers' Association Ltd., have been criticised from time to time in these columns because of the tendency to base too firm conclusions on too few tests. As Consumers' Association has grown more prosperous through increased popular support, standards of testing have improved; but the results bring out more clearly than before the remaining shortcomings of those standards. This month it is the ubiquitous electric lamp that comes under the inspecting eye of *Which?*. The tests carried out make a real attempt to tackle inevitable variations in quality, with 50 nominally identical lamps of each of nine brands, tested for life and for efficiency at various stages throughout life. In discussing the results, attention is given to considerations such as the relatively high importance of long

life rather than high efficiency when lamps are inaccessible for replacement. But this altogether welcome attempt at dependable accuracy is in part discarded in the obstinate attempt to find a "best buy." An apparently arbitrary choice is given, based on a table of total cost (lamp plus energy) for 600 lumens for 1,000 hours. The table, for some unexplained reason, excludes what appears to be the lowest total cost performer, and the recommended type is only second cheapest amongst those listed. Worse, the report concludes with an unobtrusive paragraph emphasising, correctly, that since the tests were made on 240 V, 60 W pearl bulbs, the relative results must not be taken to apply to other types and ratings of the makes of lamp tested. It seems cynical to publish the report if that warning is indeed intended to be respected. Housewives who follow *Which?* selections will doubtless ignore it. Despite the effort at more adequate testing the recommendations are again too firm.

TRAINING IS A GOODWILL EXPORT

At any one time, there are about 4,000 graduate engineers from overseas undergoing practical training with industrial organisations in Britain, compared with perhaps 7,000 British graduates. That is an FB estimate covering all branches of engineering and it sets the background for a discussion last week on the circumstances in which such men are trained. Realism is easily lost to idealism when such questions are considered. It is necessary to keep in mind as the boards of the individual companies who receive them certainly will, that training for the 4,000 visitors is not wholly an altruistic gesture. Besides, wish to help, there is a desire to impress with the qualities of British engineering, to familiarise visitors with British practice, so that they will be more likely to become customers when they return to their own countries—and customers not only of Britain, but more particularly of the firm that trains them. Yet that end will not be gained if overseas trainees receive a bad impression of British standards, and it seems from the discussion that they may be in danger of doing so. They do not wish to be trained to British professional institution requirements; they want to learn less about production, more about how to be knowledgeable purchasers, skilled operators and maintenance organisers. Because of this, they do not fit in easily with the training scheme organised for their 3,500 British fellow-graduate trainees. Above all, they want to be in touch with practising professional engineers, rather than the skilled technicians who play the major part in many British training schemes. The discussion last week hinted at more Government help in finance and staff to bridge the gap between small-firm reality and longer-term national interest in this matter, and that a question which clearly deserves consideration, for the training load on the largest firms is already unduly onerous.

Meteor

Modern aspects of switchgear standardisation

by D. E. Lambert,* B.Sc.(Eng.), M.I.E.E., Mem. A.I.E.E.

MANY papers and articles have been written on the subject of standardisation of switchgear, and more are bound to come in the future as the results of scientific research and development are applied both to the technical and production engineering aspects of switchgear. During the last decade much progressive development has taken place in the transmission and distribution of electricity, in switching devices, in materials and in manufacturing techniques. No comprehensive consideration of switchgear standardisation would be complete without reference to "Rationalisation," in the sense of the reduction of the number of different types and constructions and the concentration of research and manufacture for efficient production. During recent years the British Productivity Council have been largely responsible for

introducing the term "Variety Reduction," which has much the same import as rationalisation. They have emphasised the need to achieve by this means greater productivity and more economic manufacture.

It is a good thing in any industry or organisation to take stock periodically of existing practices and products, to ascertain whether the best use is being made of new developments in techniques and in materials, whether an overall economy can be achieved and whether policy is directing efforts in the right channels. Standardisation should keep pace with such developments. Generally it should follow practice, but there are instances when it can and should proceed in parallel.

* Mr Lambert is with Brush Electrical Engineering Ltd.

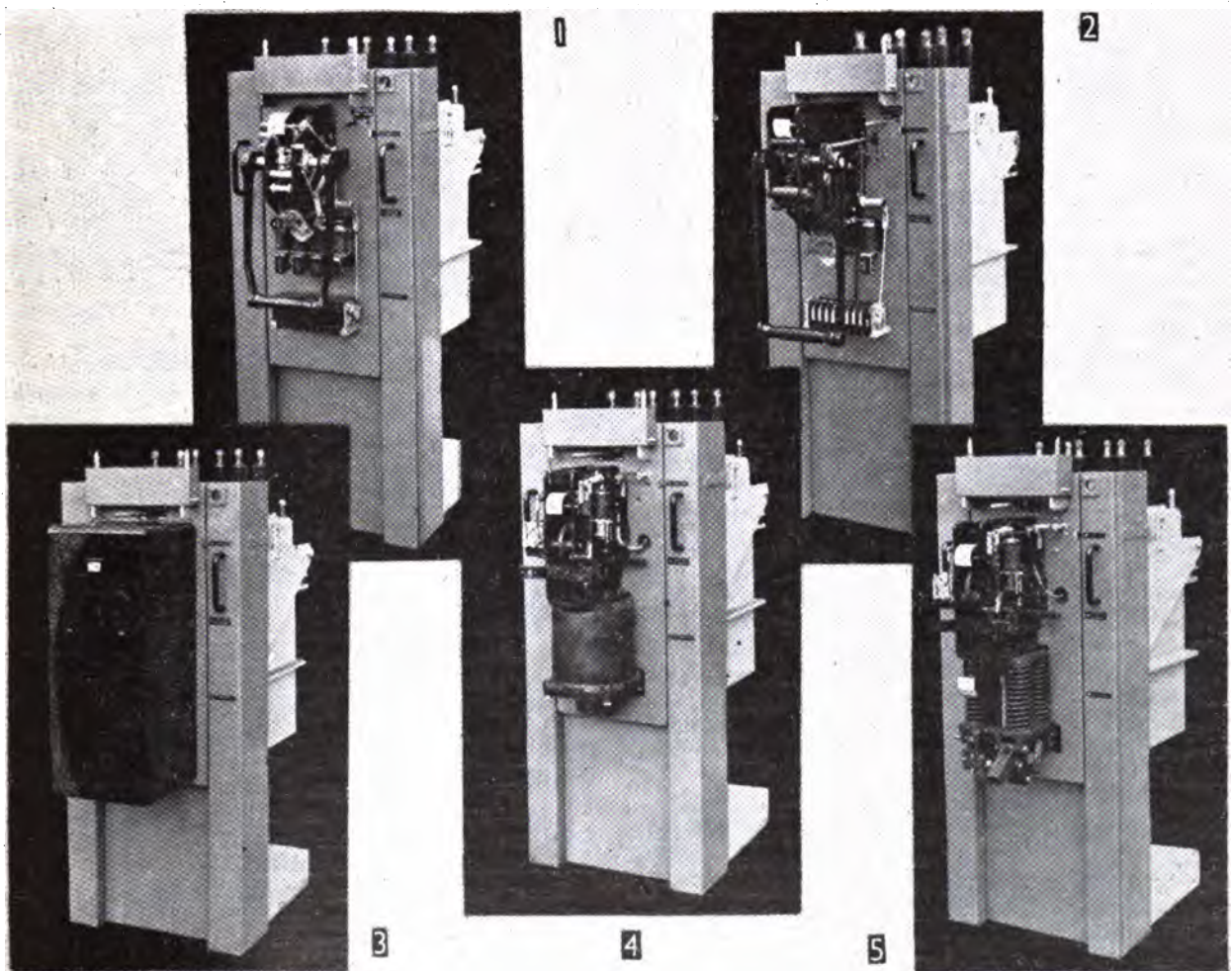


Fig. 1. Alternative types of 6.6/11 kV circuit-breaker operating mechanisms. 1. Manually-operated mechanism. 2. Manually-operated mechanism with assisted spring closing. 3. Circuit-breaker mounted on truck with mechanism enclosed. 4. Spring-closed mechanism. 5. Solenoid-closed mechanism. The manufacturer may be asked to supply all these mechanisms for effectively the same circuit-breaker

Some aspects of the present position with regard to switchgear standardisation are given in this article, and particular reference is made to variety reduction in the range of switchgear up to 11 kV.

International and National Standardisation

Each year progress is made in the meetings of the International Electrotechnical Commission towards the unification throughout the world of technical standards for switchgear. The work is undertaken by two committees, one dealing with switchgear with voltage ratings above 1,000 V and the other with ratings of 1,000 V and below.

The committees concerned have been most active and a number of publications have already been issued during the past few years. In the high-voltage and extra high-voltage fields, these have covered "Recommendations" for circuit-breakers in respect of short-circuit testing, normal load conditions, insulation, selection, and erection and maintenance. At the present time, consideration is being given to Recommendations for switches and isolators, for circuit-breaker switching of overhead lines, of cables, of capacitor banks and of small inductive currents. In the medium- and low-voltage field, comprehensive Recommendations have been prepared for circuit-breakers for distribution service and for contactors. The current work covers the finalisation of these with associated considerations of insulation and protective enclosures. Another specification for circuit-breakers for more onerous conditions (e.g., control of power station auxiliaries and vital industrial plant) is under discussion. Meetings of both IEC Committees take place in New Delhi this month.

All this work would be of academic interest only without the implementation of these IEC Rules by countries of the world in their own national standards. This is being done slowly but surely, and it will mean in due course that switchgear, and in particular circuit-breakers, with given voltage, normal-current and breaking-capacity ratings will have the same technical performance irrespective of their country of manufacture.

Britain can claim to have led in many aspects of this work and the results achieved, which in general line up closely with British Standards, are some compensation for the not inconsiderable cost expended by all sections of the electrical industry in this country on this work.

It is also true to say that so far as equality of technical performance is concerned, the results should have a marked significance in any future European Common Market arrangements. Acceptance of IEC recommendations would undoubtedly be a solid foundation for the building of a common technical structure. The commercial aspect, however, is not so clear, as prices quoted by the various European manufacturers will depend on many other factors, not the least among them being standards of safety accepted in the various countries as operational requirements. One example of this is interlocking against inadvertent faulty operation of one sort or another, which is considered to be of great importance in this country, but is not viewed with quite the same emphasis on the Continent.

As regards implementation of IEC standards in this country, committees of the British Standards Institution are constantly reviewing and revising standards for switchgear. For example, an amendment to BS 116:1952, "Oil Circuit-breakers for Alternating Current Systems," has recently been issued, dealing with short-circuit testing, in which many requirements of IEC rules and of established practice at ASTA Testing Stations have been incorporated. Similar remarks apply to the recently published specification BS 936, "Oil Circuit-breakers for Medium-voltage A.C. Systems." This supersedes the War Emergency

Edition of the specification. (See ELECTRICAL TIMES, September, 1960.)

Another specification, BS 162, "Electrical Power gear and Associated Apparatus," is about to be revised in revised form. The previous edition was published in 1938 and there are obviously many changes to be made to bring it into line with current practice and recent developments. An important revision of the standard safety requirements for outdoor open-type switchgear, 1938 edition, whilst giving some general guidance on the matter, has been considerably extended and modified. Illustrations have been included to indicate the clearances required for maintenance of the apparatus and the delimitations of work sections, with special conditions in the United Kingdom.

Impulse-voltage withstand levels have been included for open-type outdoor switchgear at service voltages of 22 kV and above, and clearances to earth and between phases are related to these impulse voltages. Two new sections have been added to the standard. One deals with control, metering and relay equipment and the other specifies requirements for battery and control auxiliary systems.

Appendices have also been included on insulation coordination and on the selection of clearances.

The same BSI committee is also finalising a new standard, BS 158, dealing with marking and arrangement of switchgear busbars, main connections and small wiring. This standard is being considerably simplified compared with the previous 1938 edition, and should enable manufacturers to reduce the variety of cables used for wiring. In the latest draft it is proposed that all wiring should be coloured black unless specified by the customer, and even then, only colours in a limited number of the standard are to be used. The main identification of the wires is by number, and an appendix has been prepared which gives functional identification (i.e., circuits) very much in the lines of that adopted by the electricity boards in this country. This should reduce drawing office work, particularly in diagram sections.

Variety Reduction or Rationalisation

There are two aspects of variety reduction as applied to switchgear. Both ultimately concern the manufacturer. One is the responsibility of the user to effect a reduction in the variety of his requirements and to simplify them. The other refers to reduction by the manufacturer of the variety which can be achieved in considerable detail through design through manufacture to stocking and selection.

Since 1948 the generation, transmission and distribution interests of the industry in this country have concentrated a great deal towards standardisation by the uniformity of their own requirements in the form of switching and chasing specifications. These have resulted from studies of system and operating conditions by the electricity boards, and many of the specifications have been prepared in collaboration with representative switchgear manufacturers. In general, these specifications conform to British Standards. In some instances they are more severe to meet conditions and requirements peculiar to this country.

There is still the need for further reduction of requirements. As an example, the British Standard Specification "S2" for 6.6/11 kV standardisation switchgear has achieved prominence as a basis of requirements for distribution systems (the nauseating colour of the original draft was its being referred to as the "Yellow Peril") as a compliment to its original authors, and also as

able import to manufacturers at the present time, that some overseas buyers are quoting "S2" in their inquiries. Even so, there are a number of detail variations of the component equipment called for by one electricity board or another due to existing systems of control, or of protection, or because of standards previously well established, or because other electrical apparatus, for example transformers, may have a higher electrical standard in one particular technical aspect. In time, it is hoped that these variations may be unified, not by invoking the highest common factor, but by adopting the simplest common denominator which satisfactorily meets the overall requirements.

One electricity board has already standardised on six basic types of 6.6/11 kV equipment, covering the range from a switch without protection to a circuit-breaker embodying over-current and earth-fault protection, and with re-closing relays. The electricity board calls for a number of panels of type A to type F, and the manufacturer has standard arrangements, including wiring diagrams, to specify to his production engineers with the minimum of engineering or drawing office work. This kind of standardisation is beneficial to both user and manufacturer.

It has been said, with some justification, that the situation existing today, with so many types of switchgear, circuit-breakers, switches, isolators, switch fuses, mechanisms, cable boxes, etc., is one which may be laid at the feet of the manufacturers. Often, this can be traced to the differing requirements of discerning purchasers, translated into being by the individual creative instinct of the designers.

There are certain components of switchgear which have been developed over the last few years to meet requirements of users and which have added to the variety of designs within a particular range. One example of this is operating mechanisms. For a 400 A, 11 kV, 150 MVA circuit-breaker, the more usual types of mechanism which the manufacturer is asked to supply are manual, manual operation with assisted spring closing, spring and motor wound spring and solenoid (Fig. 1). For the same range of switchgear of heavier current ratings, such as 1,200 A, or 1,600 A, a different spring mechanism or, alternatively, a stronger solenoid mechanism is usually required, and so the number of different mechanisms increases, the parts required increase and the stocks increase. Manual operation for circuit-breakers of ratings not exceeding 150 MVA at 6.6 kV and 11 kV has been the accepted type for the large majority of switchgear installations. This is the cheapest form of mechanism, but its correct operation is largely dependent on the skill of the operator. Now that satisfactory mechanisms have been developed incorporating a spring device in such a manually operated mechanism, it makes the closing operation of the circuit-breaker consistent and independent of the operator and should cost very little, if any, more than the straight manually operated mechanism. In the future, for the safety of operators and for reduction of variety, this more modern arrangement should replace manual operation, at least up to ratings of 250 MVA at 11 kV, and so eliminate one of the varieties.

At the present time in this country, in the voltage range up to 11 kV, technical requirements in relation to impulse

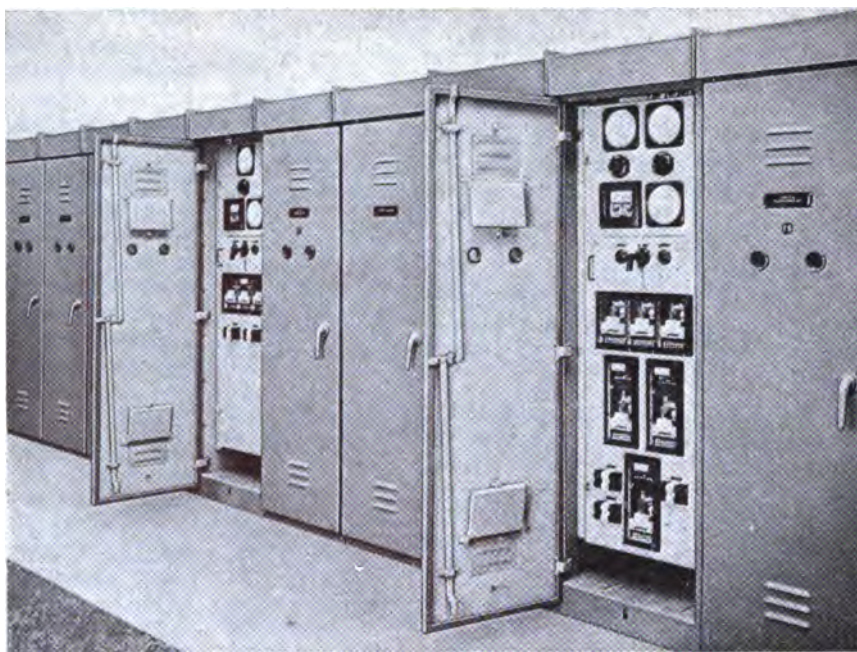


Fig. 2. Part of metal-enclosed outdoor switchboard showing control panels

voltage levels, to methods of earthing, and to overload ratings, are under discussion between users and manufacturers. It is not unlikely that changes in the design of component parts of the switchgear will have to be made to meet these requirements and this will also probably lead to an increased amount of testing. During the last ten years the manufacturer has been involved in making a considerably greater number of tests than hitherto and this has naturally resulted in increased costs.

Standards of Performances

One of the problems confronting switchgear manufacturers is, how to maintain the standard of performance and quality required in this country at a cost which will allow the product to be offered overseas at a competitive price. Assuming as a nation we must continue to export switchgear (in 1959 it was about £18.3 million), the need is greater today than ever before to reduce costs. Many of the Commonwealth markets which have been open to us are diminishing on account of import tariffs and local manufacture. There are other overseas markets which can be developed, but in many cases these will be more competitive than those we have enjoyed in the Commonwealth areas.

The manufacturer must therefore consider all aspects of cost reduction of the product, including reduction of variety, design, methods of production and the use of recently developed materials.

The sales policy of a manufacturing company largely determines the variety of products to be manufactured. Obviously, there should be a measure of diversity to give an adequate range to the products for customers, and also to avoid having "all one's eggs in one basket." Designers are responsible for evolving the minimum number of designs to satisfy the sales requirements, and it is essential for such designs to be evolved together with production engineers in order to produce the most economical unit from both the engineering and production aspects.

Many examples could be quoted of reduction in variety already achieved by manufacturers. One manufacturer decided to review his range of medium-voltage cubicle

switchgear and it was found that for a wide field of application there were 41 different designs of cubicle to meet the requirements. This combination was made up of two different heights, eight different widths, and six varying depths. After consideration from the design and production points of view, it was found possible to standardise on one height, and seven widths, three depths, thus resulting in only 16 different designs of cubicles. Furthermore, the method of construction and fabrication of these cubicles was standardised and has resulted in even greater cost reduction. Similarly, cable boxes and cable glands have been rationalised. By reducing variety and introducing pressings and mouldings for cable glands, production costs have been reduced to about 20% of the former figures.

Instruments and relays are commonly known as "subject to contract" items. They are often mounted on panels above the switchgear. Benefits to both manufacturer and customer can accrue from standardisation of the positioning of instruments and relays on these panels. The "S.2" Specification, previously referred to, did, to an extent, cover this, but there are a very large number of other requirements for relay and instrument panels on which the equipment is specified to be mounted in defined positions. One manufacturer investigated the possibility of the standard positioning of components on alternator control panels and a large measure of standardisation was found to be possible. Not only were the positions of the components fixed, but the wiring diagram was standardised, and customers' extension panels were identical in this respect to previous ones supplied. There is still considerable scope for greater standardisation in this respect.

Types of Switchgear and Circuit-breakers

No great change in rationalisation of the types of switchgear has taken place during recent years. For the highest voltages in this country of 275 kV and 380 kV, and the breaking capacity ratings up to 15,000 MVA (or even greater)—outdoor open-type switchgear with air-blast and bulk-oil type circuit-breakers is still favoured.

At lower voltages, from 6.6 kV to 132 kV, small-oil-volume circuit-breakers are in limited demand in addition to those mentioned above. Both indoor and outdoor open-types of switchgear are available and at 11/15 kV and 33 kV greater emphasis is now being laid on the outdoor enclosed or package type switchgear both in this country and abroad. An example of this type is shown in Fig. 2.

Considerable advances have been made in the development of air-break circuit-breakers up to 11/15 kV application, following established practice for some years in



Fig. 3. 11 kV current transformer and v.t. orifice with central conductor encased as assembly in epoxy resin. 1. Secondary winding. 2. Primary winding. 3. "C" core. 4. V.T. orifice and contact

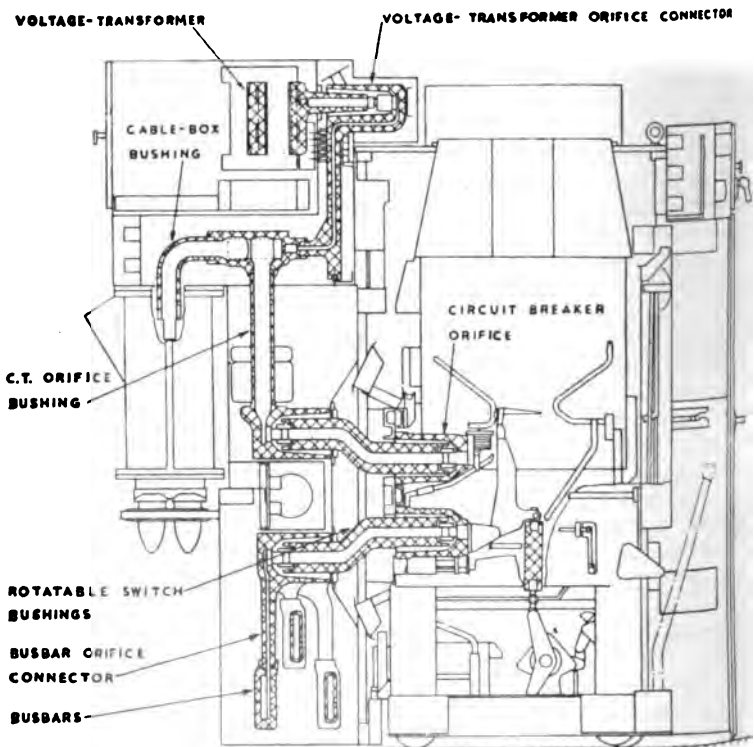
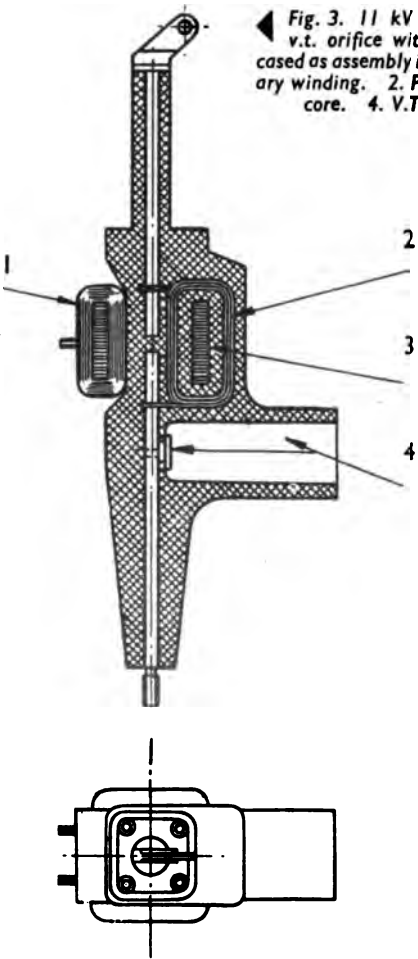


Fig. 4. Indoor air-break switchgear unit for 1,600 amp, 11 kV, 500 kVA, showing resin sub-assemblies. (Courtesy A. Reyrolle).

a. There is still a preponderant volume of bulk-oil circuit-breakers sold in this market and it is likely to be, particularly for normal current ratings up to 15 kV. In medium-voltage application, both air-break and oil-circuit-breakers are being supplied, depending upon the duty required and their location. The decision must be made of the switchgear development has taken place as a result of new materials and production techniques associated with them. Plastics, resins and other such insulating materials have not been applied as a means of insulating connectors of metal, but the whole design of the switchgear is reviewed around the use of such materials which do not enclose or encapsulate the conducting parts. This work is continuing, particularly for voltages up to 11 kV, and examples 3 and 4 show examples of modern achievements. A research and development work has taken place in America and to an extent in this and other countries in vacuum-type circuit-breakers and to a lesser degree in the use of sulphur-hexafluoride (SF₆) as an arc-quenching medium. Both these types are in production in America but with limited application. One of the disadvantages of the vacuum-type circuit-breaker has been

"current chopping" and consequential dangerous over-voltages. This has tended to limit its performance on short-circuit to about 150 MVA at 15/18 kV, but recent information indicates that higher values of breaking capacity can now be obtained. With such developments taking place—the possibility of any standardisation and reduction in the number of types of circuit-breakers or of switchgear appears remote.

From the users' viewpoint, greater variety may add confusion in the choice of the most appropriate type, particularly bearing in mind the reliability and good service provided by existing designs.

The consoling thought is that British switchgear manufacturers are very much alive to the problems confronting them today, namely, the need to keep up to date and lead wherever possible in the development of newer and better switchgear, to simplify designs and generally reduce costs of production so that the product may be saleable competitively in this country and in the export market. Each manufacturer will have to make the choice of the types which he considers the right ones to produce, limiting the diversity of products consistent with market requirements to give economic manufacture and suitable profit return.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Deliveries

I AM sure that your correspondent Mr Wilson has unwittingly misunderstood the purpose of BEAMA's comment on the remarks made on the previous question. There is no question of complacency, the need to correct erroneous impressions abroad. BEAMA was in fact invited by the overseas press to explain the circumstances of this particular case and the comment to which Mr Wilson refers was the direct result of this.

Our achievements, with British electrical exports valued at around £300 million, are good but have earned no sort of complacency in the industry. The BEAMA Survey of the European Market and our co-operation with the engineering trade associations of the Six and the Seven indicate our awareness of problems and possibilities of the European market.

The Commonwealth remains the major outlet for our engineering exports and the fact that we thought it necessary to correct a wrong impression which could harm our Commonwealth trade must not be interpreted as complacency.

S. F. Steward, C.B.E.,

DIRECTOR, THE BRITISH ELECTRICAL AND ALLIED INDUSTRIES MANUFACTURERS' ASSOCIATION, LONDON, W.C.2.

Working for Safety

MR C. McALLISTER (ELECTRICAL 3 November) is to be envied! Few persons, I think, would be so constituted as to retain their mental faculties unimpaired—much less their power of concentration—whilst gripped in the throes of a severe electric

shock from my own experience of two severe shocks, one at 200/240 a.c., one's muscles contract, something in the manner of rigor mortis and one feels that one is being torn limb from limb. It is an awe-ful experience, the real meaning of the word, and one is practically

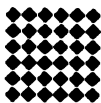
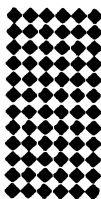
beyond coherent thought and quite incapable of action.

The first time (I was 15 at the time) a number of carbon lamps included in temporary wiring went out, owing to a loose joint; the electrician being away for a short time, I jumped at the chance of repairing the fault and earning the thanks of the builders.

It was quite safe, for was I not standing on wooden steps? I was. But not for long! As soon as I started to re-make the joint with my bare hands. I was seized with the symptoms described above and was afterwards told that my screams could be heard the other side of the High street, and that the old building foreman was so upset that he could not eat his lunch. All I know is that I seemed to lose consciousness and next thing I was on the floor, still on my feet and cursing the workmen near by to the best of my ability for playing such a trick on me! (I thought at first that someone had somehow connected an earthed wire to the soles of my feet.)

The second time was three years ago in a switch room in Hobart, (Tasmania). This time, I had been checking for overheating on the switch-board, by touch. Medium voltage three-phase. I had finished my inspection and was idly standing at one end of the board awaiting the return of my assistant. Grasping the angle-iron upright with my left hand I casually grasped a neutral busbar with my right—to see if that was warm. It was! But it was not the neutral but the blue phase. I can only excuse this as a temporary mental aberration due to over-tiredness. Three thoughts only occurred to me in swift succession: I was alone. I could not get away. This was goodbye to everything. Next thing, after a seeming eternity, I was flung very violently against the wall and collapsed in a heap on the floor. It seemed incredible that I was still alive and still had the use of my limbs, with the exception of my left arm. It was found later that I had a fractured scapula, which kept me out of circulation for a few weeks. A merciful escape, I feel.

R. St. C. Ison,
CHELTENHAM.



Training overseas graduates

URGENT PROBLEM FOR BRITISH INDUSTRY

OVERSEAS graduate engineers come to Britain in large numbers to receive practical training. As many as 4,000 may be training at any one time. Is all well with the arrangements that apply to them? Do they leave with the sort of impression of the UK that will encourage them to deal with Britain when they attain positions of responsibilities in their own country? These questions were talked about at a joint meeting of the three senior engineering institutions in London last week, when a paper* was presented by Dr W. Abbott, who is director of studies with the Federation of British Industries.

Dr Abbott is outspoken in his paper; he was still more forceful in his oral presentation of it. He thinks the state of present training schemes gives rise for disquiet, not only for overseas graduates but for our own graduate engineers as well. He fears too much accent on craft skills and not enough contact for the trainee with professional engineers, although the electricity supply authorities were specifically excluded from this charge.

Dr Abbott suggests that although it is necessary for professional engineers to know about techniques in use, those techniques change rapidly and it is important not to stultify youth by giving them too close an acquaintance with old techniques.

Training Problems

In his paper, Dr Abbott says that there are two main types of engineer wishing to come for training in the UK. One is the young graduate with little or no experience, the other the mature engineer with considerable experience who requires up-to-date information. Too often, the graduate finds himself regarded as an apprentice. His training is controlled by an apprentice supervisor interested in giving him craft skills. Sometimes, because of trade union practices, he can only observe, not take part in work, and he becomes bored. Less trouble is found in giving experienced engineers what they require.

An important point that needs realising about graduate trainees from overseas is that they are often not interested in becoming members of British engineering institutions; so schemes of training that satisfy institutions' requirements have no particular merit from the graduates' viewpoint. A common complaint of engineers concerned with industrial products is that the training is designed to fit the trainee to become a producer, whereas the requirement overseas is for men able to purchase, install, operate and maintain. Often, overseas graduates are not interested in becoming the "complete engineer" in the British sense of the term. Frequently, the trainee would prefer to spend time with several firms rather than stay with one.

Another complaint often voiced concerns the difficulty overseas trainees have in obtaining answers to the ques-

tions that they wish to put about technical matters. Their lack of contact with professional engineers has already been mentioned. Dr Abbott says:

If management believes that it is good policy to receive into their works for training selected men from other countries, who are destined to become industrial leaders in those countries, it would appear that management should give much more attention to this particular question. Otherwise, the outcome of the graduates' stay with us will not always enhance our national engineering reputation.

Dr Abbott recalls that the late Sir Claude Gibb felt particularly strongly on this point and urged a new approach in respect of it upon directors of firms likely to be involved.

Future Action

After discussing the impact of life in the UK on overseas trainees, Dr Abbott points to the lack of statistical information about the amount of training of overseas graduates at present given in this country. He feels the Government might help obtain more reliable figures.

Dr Abbott acknowledges that some of the smaller firms who might be prepared to play a part in training overseas engineers can reasonably argue that they cannot do the job effectively unless they are assisted financially.

DISCUSSION

Mr S. E. GOODALL (AEI) in opening the discussion, appealed to younger professional engineers in particular to ensure that they got in touch with any overseas graduate trainees they could, to help and advise them. He agreed that from the commercial angle, to give more attention to the requirements of overseas graduates would pay dividends.

Another electrical speaker in a discussion which attracted many contributions from the other branches of engineering was Mr R. G. BELLAMY (Electricity Council) who said that in the last ten years the supply industry had taken over 1,000 people from 66 countries for training. He agreed with Dr Abbott that the common denominator with overseas graduates was intellectual curiosity, a desire to make full use of their potential, and to meet and know British people. Training schemes, he felt, should be flexible.

Mr R. F. MARSHALL (AEI) suggested that to flit from place to place in training caused the lack of social contacts and absence of contact with professional engineers that had been complained about. Mr J. M. STOCK (Uganda EB) expressed surprise that the countries of East and West Africa were omitted from the FBI scholarship scheme; they had an enormous potential demand for engineering products. The time available for Britain to help was limited, for other countries would take advantage of the present situation if the UK did not.

Mr G. S. LUCAS (AEI) thought that one object of graduate training should be to give a man confidence to stand on his own feet when all the apparatus for which he was responsible had broke down, and he had to get it going again.

Various graduate trainees spoke in the discussion, voicing mixed views. Dr Abbott, in his reply, paid tribute to the training scheme of AEI, which he called "nearly perfect."

* Paper 3358: The training of overseas graduate engineers with particular reference to the FBI scholarships scheme, by W. Abbott, C.M.G., O.B.E., PH.D., B.SC., M.I.MECH.E.

Motor control gear for alternating current ships

by R. A. F. Craven,* A.M.I.E.E.—Part 1

CONTROL-GEAR engineers and users gained much experience in the design, performance and utilisation of a.c. motor control-gear for marine use when it was adopted by the Admiralty for RN ships shortly after the war. What has always attracted industry and attracts shipbuilders about the use of a.c. is the high reliability and low maintenance needs of the squirrel-cage motor and if these advantages are to be exploited it is essential that motor control-gear must be just as free from trouble and equally robust.

Eighty technical problems are involved in the design of contactors and relays (especially in their a.c. magnetic circuits) when they are asked to withstand the Admiralty standard shock test; but fortunately control-gear for merchant ships does not have to withstand this test, and it is only in the adaptation of relatively standard industrial motor-gear to marine work that some minor problems arise.

Easy maintenance is never more desirable or necessary than on board ship. The first essential for motor starters is front access, while starters with withdrawable interiors are even better. The advantage of the multi-motor control gear has been recognised fairly recently and a typical example is shown in Fig. 2, where there is a group of starters for motors ranging from 5 h.p. to 150 h.p. Fig. 1 illustrates a control centre with draw-out starters.

The general design and appearance of this type of equipment is very similar to its industrial counterpart. It has a rear chamber running the length of the board, either at the top or bottom, with vertical tee-connections (risers)

feeding each section of tiered starters; in each section there may be one to four or more units. Each starter has its own h.b.c. fuses and isolating switch. It is better for the isolating switch (or disconnect switch) to be capable of interrupting stalled motor current so as to eliminate mechanical interlocking between the isolator and contactor; this type of disconnect switch is being used more and more in industrial motor control centres, especially where high reliability is needed.

To be able to withdraw starters for maintenance is an obvious advantage for shipboard use where working space is usually restricted and maintenance work in heavy seas very difficult. Draw-out units for motors larger than 100 h.p. or for auto-transformer starters become unwieldy and normal built-in, front-access starters are used; they can nevertheless still be embodied in the same control board as the draw-out starters.

The enclosure is constructed and finished so as to withstand both heavy usage and high humidity. This is equally true of single starters and multi-motor starters.

It is good practice to construct busbar systems sufficiently robust to withstand the electromagnetic and thermal effects of short-circuit current. And although prospective fault levels of, say, 25 MVA can only occur on larger ships, many control-gear manufacturers customarily construct their busbars to withstand 36 kA rms (i.e. 25 MVA at 415 V) for periods up to three seconds as a standard. Some idea of the problems involved in the design of busbar and busbar connections is given by considering that the peak force between bars spaced at 3 in. is about 2 tons/ft run for a 36 kA rms (96 kA asymmetrical peak) fault current.

Figs. 1 and 2. Left, Draw-out type starter unit, 300 amp d.o.l. (AET). Below and right, control centre for tanker, 1 to 140 h.p. units. (Watford Elec. and Manfg.)



* Mr Craven is a director of Watford Electric and Manufacturing Ltd. The article is based on a lecture given at the Royal Technical College, Glasgow, in a series on alternating current for marine auxiliaries.

Although this practice may seem lavish, it is obvious that thermal and electromagnetic effects of fault current on the busbar and connection system in one part of a control centre should not put the whole out of action. It may at first be thought that the control board could be supplied through h.b.c. fuses, and thereby remove the need for such elaboration, but it must be remembered that the shut-down of a complete board, because of a blown fuse, would not be very welcome.

Given soundly built busbars and risers, the next important requirement for draw-out starters is that the withdrawable connection is designed (and manufactured!) to withstand (i) continuous vibration and (ii) the peak current let through by the protecting fuse. Clearly, a short-circuit on the load side of the fuse must not produce contact disturbance and possible arcing and breakdown at the point of connection to the busbar riser. A 300 A h.b.c. fuse would cut off at about 25 kA on a 25 MVA fault, and unless contacts are very good they may very well be blown away from the riser by current constriction and/or electromagnetic forces. The aim is to make sure that any fault is contained within that part of the circuit in which it happens.

The elements of each starter unit, for all draw-out types of construction, are in sequence:

- (1) Plugging connection.
- (2) H.B.C. fuses.
- (3) Isolator (or preferably stalled-current breaking disconnect switch).
- (4) Overload relays.
- (5) Contactor.
- (6) Outgoing plugging connection.

The only difference between this and conventional construction is that in the latter the isolator connects directly to the busbar risers and the h.b.c. fuses follow it.

The direct-on-line (d.o.l.) starter is the one most frequently used and the only limitation is the size of the motor relative to the generating capacity; or, in other words, the maximum transient voltage dip that can be tolerated in the class of ship concerned determines the maximum size of motor that can be started d.o.l. The behaviour of alternator voltage with impact loading is dealt with by Griffin in an earlier article¹ in this series.

Specification and Selection

We will now deal with the specification and selection of each of the elements in the d.o.l. starter circuit. Throughout, the ambient temperature is taken at 40°C* as specified in Lloyd's Rules and it is assumed that the standard current ratings for the appropriate circuit elements (normally based on BS 775² and BS 587³ for an ambient of 35°C) are reduced by 10% to 20%.

Isolator. The isolator, which has no significant current-breaking capacity, is mechanically interlocked with the starter door or cover and since in emergency it could be called upon to open currents up to eight times full load at a power factor of 0.2 to 0.3, it must be electrically interlocked with the contactor so that the contactor (seemingly) opens before it. Unfortunately, many possibilities, such as a welded contactor, make infallible interlocking impossible. Always there is the very real risk of opening an isolator on load and so starting an arc fault which is destructive to the equipment and dangerous to the operator.

Unquestionably, for shipboard use, on-load isolators (by definition no longer isolators, but disconnect switches) should be specified so that electrical and mechanical inter-

locking become unnecessary and the motor circuit can be opened with impunity under any condition of load.

Fuses. Fuses provide protection against over-current as distinct from overload. Regardless of the size of the ship, only h.b.c. fuses should be used. Normally, Class AC4 is selected, but in the event of a fault capacity exceeding 25 MVA (only true for the largest passenger ships) Class AC5, which is suitable for 35 MVA, should be specified.

The fuse rating chosen depends on the motor-starting current and accelerating time and is normally two to three times the motor full-load current. Fuse manufacturers provide data on fuse selection for motor starting.

It is important that, in general, each motor starter in the group has its own fuses. It is bad practice to feed several starters through one set of fuses without further protection.

When a complete multi-motor board is supplied through fuses it is necessary to make sure that discrimination between individual starter fuses and the supply fuses is obtained. This is discussed by Jacks⁴ very fully, but a rule of thumb ratio of 2:1 for the major to minor fuse is generally acceptable as a minimum.

Overload Protection. Protection of the motor from overheating due to overload is provided either by thermal or electromagnetic relays and it is safe to say that of all the components involved in a.c. motor control gear the overload protection relay presents the most difficult problems.

The arrival of the c.m.r. marine motor to BS 2949⁵ which has no rated overload capacity, intensifies the problem, and the rough-and-ready setting of overload relays at $1\frac{1}{2} \times \text{f.l.c.}$ is quite unsuitable.

BS 2949 gives a permissible temperature rise for Class A insulation of 90°C for totally enclosed motors. This means that with a relay set to trip at $1.15 \times \text{f.l.c.}$, which also happens to have the maximum error of 10% permitted by BS 587 in tripping current, the hottest spot temperature of the winding is about 155°C for an ambient of 45°C. Insulation life is considerably reduced at this temperature: a very rough estimate suggests one-twentieth of its normal life. The need for precise overload relay calibration and clarity and ease in setting is obvious, but it is rarely fulfilled by manufacturers.

Griffin,¹ in an earlier article, suggests that the temperature rises specified by BS 2949 for the sometime ambient of 50°C are too high and it is well to recall that the protection of c.m.r. motors to BS 2613:1957, with what would be lower hottest-spot temperatures (based on an ambient of 40°C), already presents critical and complex problems for effective protection.⁶

The relative merits of thermal and electromagnetic relays have been argued many times but, regardless of the type of relay, the following are essential points:

- (1) The current-time curve should follow the motor heating characteristic and should allow reasonable time for motor acceleration without premature tripping.
- (2) The available tripping time should decrease with increasing motor temperature (i.e. the relay should differentiate between a cold and hot motor).
- (3) The relay should withstand the let-through energy and associated peak current of the h.b.c. fuse with which the circuit is protected.
- (4) The relay should be easily set at 1.15 times f.l.c., and clearly calibrated in "amperes to trip" so that the setting can be done unambiguously.
- (5) The relay pick-up current should not change during long periods of use, nor should it be upset by a short-circuit on the load side of the relay.
- (6) The relay current-time curve should be such that the h.b.c. fuse "takes over" from the contactor at about eight times full load current, so that it is the contactor that deals with all currents within its capacity.

* This temperature is low and the author agrees with Griffin that sustained temperatures of 45°C and even 50°C are not unusual in a ship's engine-room in the tropics.

A typical solenoid relay meeting these requirements is shown in Fig. 3 and the current-time curves for it are in Fig. 5. Typical fuse/relay takeover is shown in Fig. 4.

For many years there has been a serious misunderstanding of the thermal behaviour of a delta connected motor under single-phasing conditions; this matter is dealt with elsewhere,⁶ but the fact is that an overload relay set at the essential level of 1.15 times f.l.c. inherently protects the motor from over-heating when running from a single-phase supply.

Contactors. The only special requirement for contactors for marine use is that they operate satisfactorily when inclined at any angle up to 15° transversely and 10° longitudinally and with rolling up to 22½° from the vertical. This usually means that an additional hold-off spring has to be fitted to the normal industrial contactor. Standard industrial contactors are normally quite able to withstand the normal vibration and shock experienced on board ship.

Unlike cargo-winch controller contactors, the contactors used for marine auxiliaries usually have a very light duty, both electrically and mechanically, and apart from reducing the current-carrying capacity by about 10% to 20% to meet the higher ambient temperature, the contactor should simply comply with BS 775. From Clause 53 of this standard the appropriate criteria for marine contactors are:

- (i) Current rating as affected by operational duty should be based on the EU rating.
- (ii) Mechanical duty. Class II as a minimum.
- (iii) Current making and breaking capacity category A4.
- (iv) Size of enclosure. Normally assumed to be "small air-volume" (i.e. an enclosure in which the air volume of the enclosing case is less than twice the projected volume of the contactor).

The enclosed uninterrupted rating (EUR) is clearly appropriate for marine use because auxiliaries run without topping for several days at least and the enclosed standard rating (ESR) for contactors specifies not less than one operation in eight hours. The reason for the inclusion of this condition in BS 775 is that contact operation breaks down the oxide film that progressively forms at the contact interface and so gradually reduces the contact current-carrying capacity. This condition is certainly valid for copper contacts, but it does not hold for silver or silver-beryllium oxide contacts, so for them it is not unusual to make the ESR and EUR values identical.

The mechanical duty is normally light, and a contactor having a Class II duty (i.e. 500,000 operations) is quite satisfactory.

The current making and breaking capacity A4 is unquestionably needed, for the contactor must be able to make and break stalled motor current, repeatedly if needed, and the A4 rating, which specifies making and breaking capacity of eight times f.l.c. up to 150 A and six times f.l.c. above 150 A at rated voltage and 0.2 to 0.3 p.f. is a realistic requirement. Against many industrial applications of contactors, the Lloyd's requirements of a test duty of 5,000 load operation is minor.

Perhaps the remaining important requirement, although not specified anywhere, is that the contactor should not "weld" in, and it is unfortunate that silver contacts increase this tendency. Single-break contactors, however, have a very great advantage because their contacts go through a shearing transfer action and so impart no shearing action on any weld which may have formed and if well designed on other respects single-break con-

tactors are far, far less likely to suffer from welding than double-break contactors.

A strong plea must be made that contactor contacts are never "dressed"; they are best left alone unless they are clearly worn or are over-heating.

Short-circuit Performance

The complete starter unit has now been analysed step by step and, in addition to saying that it must comply with the BS 587, consideration should be given to the performance of the complete multi-motor control board under short-circuit conditions. This extension in control-gear testing is a fairly new one in practice, although Knowles⁷ first outlined it over 20 years ago.



Fig. 3. Precision overload relays with transparent sealed dashpots. (Watford Electric and Manufacturing)

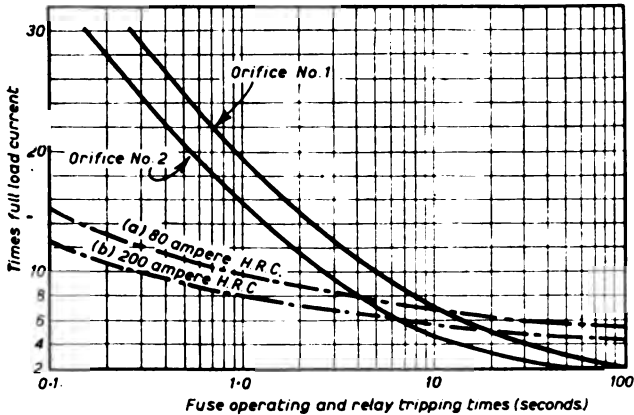


Fig. 4. Fuse operating and relay tripping times, showing crossover points. With 80 amp fuse there are 8 times f.l.c. for orifice No. 2, and 7 times f.l.c. for orifice No. 1. With 20 amp fuse, the respective values are 6.3 and 5.5 times f.l.c.

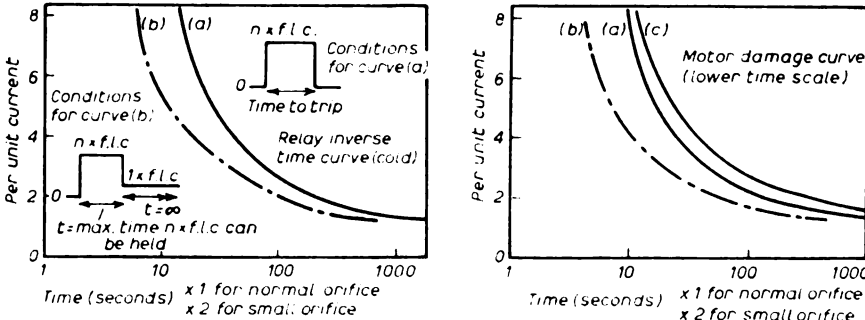


Fig. 5. Current-time curves for Watford Electric and Mfg. overload relay shown in Fig. 3

It would be very difficult to discuss the whole technique of short-circuit testing in this article. In outline, a complete board should be type-tested at a short-circuit testing station and evidence held available to show that for each size of starter, with its outgoing terminals connected to form a bolted fault, the starter contactor has been closed against a specified prospective fault, thereby initiating fault current. In this test, the h.b.c. fuses blow, but there should be no evidence of breakdown elsewhere and, apart perhaps from the contactor contacts, the equipment should remain usable.

Vulnerable points are the plug contacts of draw-out type starters, isolator contacts and overload relay heaters or overload relay solenoids. Failure of plug isolator contacts (which, if they are "blown off" under the action of the cut-off current of the fuse, may initiate an arcing fault on the live side of the fuses) would not normally be expected with the h.b.c. fuses of less than 200 A rating. Welding of isolator or plug contacts could be considered to represent a poor performance because access to the starter may become very difficult if it were to happen in practice and the weld was a heavy one.

These type tests should be made on each size of starter and it is obvious that the highest fuse rating combined with the lowest rating contactor and overload relay should be chosen for each size.

In addition to this, it is customary for busbars and connections to be tested at 15, 25 or even 35 MVA prospective fault for 0.2, 1.0 or 3.0 seconds.

Clearly there are degrees of reliability, but it is unreasonable that motor control-gear for marine should be among the highest levels, especially where there is little room to move and failure of auxiliaries may hamper the ship. It is interesting to see nowadays how technical thought only appropriate for switchgear are now considered a necessary feature of motor control-gear by some manufacturers. And quite rightly so; there are many accidents because of the inability of motor control-gear to withstand hazards which arise when connected to prospective fault current systems.⁸

(To be concluded)

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European Ideas on Consumer Control

ACTION taken by various European countries to form electricity consumers' demands more closely to the pattern most efficient for system operation is described in a recently published study.* Although most countries have some form of two-part tariff as a basic step in this direction, many take more vigorous action to encourage off-peak use and to penalise on-peak demand.

Hungary and Poland are countries where, in the interests of the general national economy, certain heavy industrial consumers are compelled to take electric power at times fitting in with a pre-determined load diagram. In Poland and Roumania special studies are made of individual works to determine the possibility of equalising demand by operating different items of plant at different times. Austrian electricity undertakings make use of load-limiting devices which cut off the current when maximum load is exceeded.

Power Factor

A more sophisticated approach to improving efficient use of power supplies is improvement of power factor. In Hungary, installation of capacitors for this purpose is required under regulations laid down for industrial plant. In other countries, including Greece and Poland, use of electricity at a power factor below a fixed value is penalised by a progressive increase in price per kWh, or even by cutting off the supply. However, Poland has abandoned the practice of reducing price per kWh when power factor was greater than 0.8. It was found that this tariff system encouraged off-compensation which caused voltage rise difficulties at times of low load. In Turkey,

improvement in power factor is encouraged by use of kWh motors.

The arrangements by which more effective use of power system facilities is obtained vary widely from country to country. In some countries, such as Hungary, of inspection bodies charged with such improvement have been set up. Advice bureaux of one kind or another are widespread, and the activities of engineering societies exercise a beneficial influence. The UN study lists in detail the steps taken in the various countries.

Although the report with which this note is principally concerned does not give a great deal of direct information about the various organisations involved with promoting efficiency, another recent publication is *Organisation of Electric Power Services in Europe* which has in it much information about government services, officers of supply undertakings, and bodies conducting research and publicity associated with electricity supply. It is produced by the same UN committee and is obtainable from HMSO, price 5s.

Success

It appears from figures quoted in the study that widespread success has been obtained in the drive to reduce peak demands. Discussing what has been achieved the study suggests that a stumbling block is often inadequate knowledge of those in charge of industrial undertakings concerning the economics of energy. There might be advantage in organisation of courses of training in these matters.

As we reported last week, the Committee on Electricity Power of the UN Economic Commission for Europe plans for a meeting in Poland in 1962 to consider a symposium of reports on subjects such as those discussed in this present study.

* United Nations Economic Commission for Europe "Rationalisation of Electric Power Consumption," obtainable from HMSO, price 2s 6d.

Light as an actor

25 YEARS OF DEVELOPMENT IN STAGE LIGHTING

IN the complex and fascinating subject of stage lighting there are three broad spheres of approach: control, equipment and utilisation. The first encompasses the highly technical subject of switching, dimming and colour mixing of light from a number of positions at a central station, with or without facilities for "remembering" and setting up patterns of lighting at the touch of a button. The consoles, dimmer banks and even the dimming systems—manual and servo-operated resistance, saturable reactor, thyatron, transistorised, etc.—have already been covered extensively in lectures, papers and technical articles. This is essentially the sphere of control engineering. It terminates at the sockets to which the lanterns and associated lighting devices are connected.

The second deals with the design of the lanterns and light sources for connection to the control system. They come in a variety of shapes, sizes and loadings, each with its own particular function to perform. Their design is by no means haphazard; it calls for all the skill and ingenuity of the illuminating engineer with a knowledge of optics added. It is a special branch of illuminating engineering.

The third is that of utilisation. This is the sphere of the producer who uses the light to achieve his dramatic effects just as he would an actor. To him light is one of the cast. He moves and directs the fittings, each one of which is as personal to him as the actors. He has his own special favourites, likes and dislikes. In recent times the fittings have even been brought out of obscurity behind the proscenium hangings and wings to stand, stark and not always lovely, in full view of the audience.

Three Schools

In a paper presented before the Illuminating Engineering Society, London, on 8 August,* Mr F. P. Bentham, F.I.E.S., sets out to describe the developments in lantern equipment which have taken place over the past 25 years. The three principal schools of stage lighting are to be

* "Twenty-five years of stage lighting equipment."

found in Germany—influencing the whole of Europe, including Russia—Britain and the United States. Taking, first, the professional theatre, in Britain and the US the main influence is that of London's West End and New York where theatres are commercial enterprises run for profit and in which, with few exceptions, the control systems are part of the theatre but the fittings are hired by the producers for each show. In Germany, a land with a tradition of civic theatres with resident companies, lighting and equipment is on a lavish scale, even in the post-war rebuilt theatres.

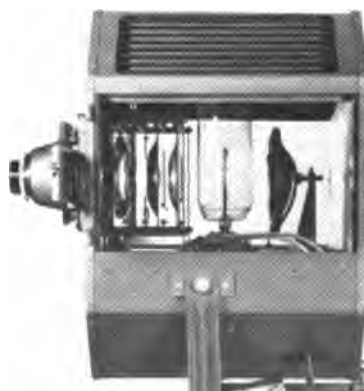
Let us consider the purpose and positioning of the lanterns, the development of which, since the days of gas-jet lighting at the end of the last century, has not been logical but rather as the result of inspiration at war with tradition.

Up to the turn of the century the proscenium stage—essentially an area one aspect of which is viewed by the audience through the proscenium opening—dominated theatre lighting which, once the gas-jets had been supplanted, was mainly from footrows, or "foot lights," at the forward edge of the stage and from battens mounted behind the proscenium arch above the actors. The development of the forestage, projecting beyond the front of the proscenium, was largely responsible for the transference of footrows out into the auditorium, the most convenient position being in the front of the circle.

The emancipation of lighting from the function of mere illumination to its use for dramatic effect came with the introduction of the spotlight, first as the now defunct lime-light, later as a carbon arc, and finally as the tungsten filament spotlight. It was at this point that the director started to use lighting for effect; in the musical shows, mainly by the use of colour; in the more serious theatre, for dramatic impact. As he developed his techniques, so did the form and size of the spotlight advance. The ultimate in the use of spotlights is in the progressive stage where, shorn of hangings and surrounds to mask the limits of the acting area, the light itself is used to focus attention, concealing more than it reveals.



Patt. 123 Fresnel spotlight, beam variable between 16° and 45°, shown in part section



Patt. 152 optical projector and effects lantern with 4 kW lamp and heat absorbing glasses



Patt. 23 baby spotlight, also in part section to show position of lamp, reflector and lens

Types of Spotlight

Focus lamps, or spotlights, were in active use before the first world war when the German influence on stage design was high. Early designs were arc-lamps housed in a metal box with a fixed focus lens and runners for colour filters. Focusing was by shifting the arc in relation to the lens, set on a removable slide. This could be taken out to give floodlighting and the usual mounting positions were on the "perch," close to the proscenium in the wings, and, sometimes, from a point high up in the gallery.

Dimming was not, of course, possible with the carbon arc, but a dimming effect was obtained by an iris shutter in front of the lens. The carbon arc soon gave place to the tungsten filament lamp, which considerably simplified matters, the usual size being 1 kW, though 2, 3 and 5 kW lamps were used in Germany for a time to get more light. The higher loadings introduced other problems which were partly solved by the Fresnel spotlight and in the US and Britain, the loading today rarely exceeds 2 kW.

The Fresnel Spot

The Fresnel spot incorporates a moulded "flat-plate" lens and was first imported here from France in the 1930s. It gives narrow-angle beam with a soft edge which can be varied over a small range by moving the lamp in relation to the lens. For the control of spill light from the edge, a "barn-door" attachment is used and mass-produced British Fresnel spots are now available in 250/500 W and 1,000/2,000 W sizes.

Mirror Spots

For true spotlighting, there is a need to have control over the beam shape rather than to rely alone on the magnification of a more or less circular filament. In an attempt to achieve this, a whole series of ellipsoidal reflector spotlights, based on an original design by Kliegl, appeared in the 1930s, resulting in a complete revolution of lighting techniques. These caught on immediately in the US, but took longer to establish in Britain and Germany. Mirror spots, or "profile spots" as they are now more usually called, were obtainable in 1 kW sizes just after the war but the introduction, in 1950, of Class T projector lamps with bi-post caps led to the development of compact, machine-produced mirror spots with a choice of four objective lenses and with 250 W or 500 W lamps. Focusing is by adjustment of the lens tube and/or lamp position in the reflector.

Effects Projectors

Spotlights with attachments for projecting cloud effects on to the cyclorama or background have been in use for many years. These have been developed to meet the needs of theatre and film producers with advancing techniques and ideas, from the back projection in colour of still photographs in place of scenery and dramatic shadow effects to the use of moving films simulating travel of the scene. Some of these equipments are lavish in the extreme, particularly those designed in Germany, and cost up to £1,000. A recent design in Britain based on a 2 kW or 4 kW bulb achieves all the required effects at under one-fifth of the price. For theatrical work, colour backgrounds are projected from slides which have been photographed by a normal colour process from an artist's design. Colour photographs of actual scenes are hardly ever suitable for stage projection since the surrounding scenery is stylised rather than factual. Black and white back projection, both still and moving, of actual scenes are, however, extensively used in films and TV.

Floodlighting

The effect of these spotlight developments on the conventional batten and footrow area lights has also been considerable in recent years. In place of the rows of small lamps in battens over the actors' head, "acting area lanterns" were developed in Germany and introduced here by Basil Dean in 1920. From these, a downward, narrow-angle, 1 kW acting area lantern with a 26° beam reflector was developed in 1935 and, to counter the preponderance of light in any one area of the stage, vertical floodlights, or "pageants," are used in the wings with an increase in the intensity of associated spotlights. The modern technique is to use a number of these lanterns, each covering a section of the stage, supported from bars hanging above the stage and separately controlled. The "pageants" are supported on floor-mounted booms in the wings or by suspended ladders.

In the past the number of different types has been high, one German firm listing as many as 55, but in recent times there has been a tendency towards rationalisation, the kernel of which is eight basic units. This has been to the advantage of the amateur theatre, which often has to plan its productions on small budgets. Today there is a range of fittings at the amateur director's disposal which enables him to emulate the work of the professional at economic cost by renting both lanterns and control boards.

Reactor Pressure Vessels

DESIGN of pressure vessels for nuclear reactors was discussed in a paper presented on Tuesday to the Institution of Civil Engineers. The author is Mr I. Davidson, M.ENG., M.I.C.E., (deputy chief engineer, development and engineering group, UKAEA).

So far as steel pressure vessels are concerned, current designs involve diameters of up to 63 ft, capable of sustaining a pressure of about 300 lb/sq in., with gas at 750°F. In addition, a graphite core weighing upwards of 2,000 tons has to be contained. This requires site fabrication in thicknesses up to 4½ in.

Design of such pressure vessels has to take account of five possible modes of failure.

Tensile failure. There should be little difficulty in preventing this happening under normal operating conditions, unless some deterioration has occurred, which would be a gradual process, giving early warning of impending trouble.

Creep and stress rupture failure. Choice of suitable materials in relation to temperature and irradiation should remove risk of such failures, which in any case would be preceded by warning signs.

Fatigue failure. The number of cycles in the life of the pressure vessel is sufficiently low to make this a problem relatively easy to solve.

Corrosion. Not likely to be serious at temperatures used at present.

Brittle fracture. If this occurred, it would cause instantaneous destruction of the pressure vessel with no previous warning. Use of suitable material together with keeping the pressure vessel above a critical temperature are the precautions adopted. The danger is particularly high before the pressure vessel is stress relieved. The minimum safe temperature rises as the age of the installation increases.

Looking to the future, Mr Davidson notes the possibilities of using prestressed concrete as both pressure vessel and biological shield.

AROUND THE TRADE

BY PEREGRIN

AND so the Fair Trading Council, which has served us for 25 years, is dying—killed by the Monopolies and Restrictive Practices Act. What a pity! I wonder if the architects of this Act could possibly have foreseen the disservice they were doing the electrical trade in general. Surely in their zeal to correct one aspect of trade they have thrown the rest out of balance. Already we have seen the regrettable state reached by the cable trade a few months ago, when it was obvious that if the resultant cut-throat competition continued, not only the quality of the cable, but eventually the workers would suffer. And certainly the shareholders got an undeserved kick in the pants.

One of the troubles is that in this age loyalties count for very little, and "I'm all right Jack" seems to be the prevailing spirit; so that I suspect that there are quite a few people in all sections of the industry who would welcome the free-for-all which could easily follow the demise of the EFTC. There is the manufacturer who goes direct to the public; the wholesaler who serves certain elements at his back door, and the retailer who tries to entice customers from his fellow traders by price-cutting and free gifts. In the long run the public who are paying are badly served, carelessly treated and enjoy neither the goodwill, the sound advice, the after-sales service, nor, in fact, the quality which should be theirs by right. There is a lesson already in the results of departing from normal channels in the closing down of the Domestic Appliance Section of Vactric Ltd. They cut out the dealer and supplied even those who had been faithful to them at full list price only. They should have viewed the success of firms like Hoover Ltd. who realise that every satisfied dealer makes contact with hundreds of potential Hoover customers a week. They should have realised that the direct-to-public door-knocking technique has become suspect these days, and realised further that they needed the dealer more than the dealer needed them.

Hesitant Meeting

It was with pleasure, therefore, that I heard of the meeting of electrical interests, called together by that wise and gallant gentleman Mr T. W. Heather, to endeavour to find an acceptable substitute for the EFTC. Quite a number of associations were represented at this meeting but, from what I hear, many of these associations had already received a caning from the Monopolies Act and had obviously instructed their representatives not to commit them, at least without further consultation. Their unenthusiastic attitude to any ideas put forward and so much apparent caution, hesitancy and dithering left everyone in doubt as to whether to meet again or to communicate direct with Mr Heather the views of their association. One would almost have thought they were a body of criminals, doubtful about the disposal of the swag, rather than representatives of long-standing associations of sane, competent business men anxious to get their products over to the public at a reasonable price, consistent with quality and safety and with a reasonable margin for efficient distribution, demonstration and service.

Why it should be so important for a worker to receive a fair weekly wage, and yet raise objections to an agreement to charge a definite price for an article so as to ensure that all connected with its distribution get a reasonable living, I do not know, but it does seem to me that joint meetings of all sections of the industry would go a long way to fill the gap left by the Fair Trading Council. The Ministry of Works set up committees to evolve a code of practice which did not bother about prices at all but which set down some very useful and practical suggestions for guidance. Perhaps the electrical industry would benefit by a similar idea. It could deal with many things left over from the EFTC, including the vexed question of price maintenance, and I am sure contractor/retailers would be grateful for it over the years. We still have before us the lesson of the gas industry, where by ruthless subsidised competition retailers were practically wiped out—a matter of regret to the gas industry, today, I have no doubt.

Area Board Trading

And talking of nationalised industries I must congratulate the Electricity Council and area boards on the way they have set out the "Contracting and Sales of Fittings" accounts. It makes unpleasant reading for the contractors and retailers who must envy the increase on the contracting—nearly £300,000 to the all-high figure of £18,456,851—and the increase in the sales of fittings, etc., by £12½ million. Much of the latter increase is accounted for by an increase in h.p. sales, and one wonders whether such a huge leap in h.p. is good for the country's economy. There really does seem to be some justification for the complaint of retailers of the boards' uneconomic h.p., but, quite apart from that, I am often much impressed by the keenness of their personnel and the efforts to obtain orders, whether for house wiring, factory work or fittings. If the retailer is to continue to hold his own, he must really take advantage of every possible outlet for publicity and service and look to the training of his staff. On this last point, of course, we all await a directive from NECTA's new training expert, Mr Jones.

Incidentally, I notice the boards are down 31% on appliances and 41% on refrigerators over the four months May to August. I can appreciate fully that 41%—it is a sore point with most retailers—and I hear that some of the big nationals are equally badly hit. And yet there are strange anomalies both in sales and in deliveries from manufacturers. The cartoon in *Punch*: "The very latest information on delivery is 3 years 9 months," etc., in respect of the apparently very depressed motor trade just about describes it. Spin dryers and cookers are a case in point. Shining new models are put on the market at a time when the sales are as dead as the dodo, and yet when a customer of mine wants the new Creda spin dryer I cannot get it for love or money.

And just as a final note—I would have thought Pakamac would have had enough to occupy their time just now without going into the electric blanket trade. I suppose soon we may see all the refrigerator firms making umbrellas or gumboots!

OVERSEAS NEWS



from our correspondents abroad

CANADA

Using Coal Resources

As part of a plan to make fuller use of the coal resources of Alberta, it has been proposed that additional steam power stations should be built in that province and their output exported to British Columbia and across Canada to the Maritimes. Under the scheme, Alberta would be called upon to produce 7,140 MW, involving the construction of steam stations which would consume about 4½ million tons of coal annually. Initially, it is suggested, the power transmission lines should run to British Columbia, Manitoba and Ontario. Mr J. G. MacGregor, chairman of the Manitoba Power Commission, seems to be favourably inclined towards the scheme.

More Embargos

Following recent announcements by the Canadian Government of import restrictions on turbo-generator equipment, Canada has insisted on, and the Japanese Government has agreed to, an embargo on sales of radio and television tubes to Canadian importers. The embargo is to remain in effect until the end of the year or until such time as a satisfactory quota has been agreed. Canadian action is aimed at holding Japanese firms to the orderly marketing agreement between the two countries, which allows for a 5% to 10% increase in imports when the market is sufficiently buoyant and not, as was the case last year, complete swamping of the Canadian market to the extent that domestic manufacturing was almost suspended.

Strong criticism of applying quota and tariff protection by the Canadian Government was given recently by Mr S. M. Finlayson, president of Canadian Marconi. He said that industry in Canada could not expect to survive the competition race by trying to erect unreasonably high tariff walls against foreign goods. Although quotas may be necessary in short term, they could not be a long-term solution to the problem of foreign competition. He said the significant difference between Canada and Japan was the incredible will to work of the Japanese which, he thought, arose primarily from a simple concept which had been allowed to drift to the back of Canadian minds that: "If you don't work you don't eat."

150 MW Stator Shipped

The first of four turbine alternator set stators was recently dispatched from the AEI Manchester works. These machines have been ordered by the British Columbia Electric Co. and are to be installed at Burrard power station. The stator weighs 155 tons and, because of inadequate handling facilities at Vancouver, it will be unloaded at the US naval dockyard at Bremerton and then sent by rail to Vancouver.

TURKEY

Light Industries

The Turkish Minister for Reconstruction and Resettlement, Professor Fehmi Yavuz, recently gave some details of plans for developing light industries. The country is to be divided into seven or eight areas and the light industries developed in each area will be those best suited to local economic conditions and requirements. It is hoped in this way to raise the general standard of living of the villagers and they would be further helped by provision of plans and building materials for constructing new homes.

GHANA

Volta Project in Initial Stages

Representatives of 22 companies recently attended meetings with the American consultants, Kaiser Engineers, in Accra to discuss construction of the Volta River project. Consortia formed include Parkinson Howard with Hawker-Siddeley Brush and Taylor Woodrow with the US firm, Morrison-Knudsen. George Wimpey and Richard Costain are also interested. Their competitors include European and United States contractors. Four Ghana-registered firms are also interested in the project, which includes a dam and power house estimated to cost between £60 million and £70 million. It will be recalled that half the cost of the project is being provided by the Ghana Government and the remainder by the World Bank and loans by the British and American Governments.

Contracts for the scheme are expected to be awarded next April. A dam will be constructed at Akosombo, 64 miles north east of Accra, which will create a lake of 3,500 sq miles on land now inhabited by nearly 63,000 people. Con-

struction work on the dam should be completed in 5½ years. The project, estimated to cost in total about £300 million, will supply power for proposed aluminium smelters at Tema.

RHODESIA

Kariba's Third Set

Half-way stage in commissioning at Kariba was reached on 29 Oct. when the third 100 MW hydro set, built by AEI, Rugby, was put on the bars. The commissioning was supervised by the consultants, Messrs Merz and McLellan, on behalf of the Federal Power Board. A further 330 kV substation at Sherwood is also being put into service.

S. AFRICA

Rail Electrification Progress

By July next year, electric locomotives will be hauling trains northwards as far as Leeugamka (formerly known as Fraserburg Rd) on the Cape Town to Johannesburg line of South African railways. Leeugamka is 60 miles from Beaufort West on the 180 mile section for electrification from Touws River. It is reported that, on this section, 80% of the catenary supports are in position and wiring, which has been started from both ends of the line, has been completed over 45 miles.

Buildings for 12 substations and 12 tie stations are completed and equipment installation is in progress. A power line from Worcester is being constructed over the mountains to the first substation north of Touws River. The entire scheme is estimated to cost about £3 million, excluding the cost of the electric locomotives.

Locomotives on the new section of line will be smaller than those running between Cape Town and Touws River and so far 55 locomotives have been ordered from Britain.

PAKISTAN

Power Resources Survey

The Government of Pakistan is shortly to undertake an extensive survey of water and power resources. The survey will cover recording of temperature, rainfall, water flow and soil formation and data which can be utilised for estimating

magnitude of waterlogging and / problems. The scheme in West an will cost about Rs18,60,00,000 ill be spread over a few years. st Pakistan, the investigation of and power resources will cost Rs5,85,00,000 and will be en- l to the East Pakistan WAPDA.

a Hydro Plan

Aga Khan is reported to be con- g participation in the Pakistan nment's scheme for hydro power nza under their second Five-Year The plan proposes a 450 kW electric plant at Hasanabad. Cost plant is estimated at Rs7 lakh. It supply villages in the area, which ated in the Karakoram mountain

INDIA

ad Dam

alled capacity of the Rihand prill be 250 MW with a firm genera- apacity of 105 MW. The dam the River Rihand in Uttar h is expected to be completed in t a cost of Rs46.05 crores. The ill be 3,065 ft long, about 300 ft und will create a reservoir with ge capacity of 8.6 million acre ft total spread of 180 sq miles. from the project will be used gricultural, industrial and irriga- e in Uttar Pradesh and Bihar next Work on the dam began in 1957 as included construction of an road 50 miles long from the rail- at Robertsganj and a bridge over ver Sone.

gement of Heavy Electricals

reported that the Government of have decided to bring under one ement Heavy Electricals at Bhopal so two heavy electrical plants to nstructed during the Third Plan

iminary reports on the two new es are being prepared by Czech oviet engineers and are expected eady by the end of this year. Both es will employ between 15,000 and eople and, while technicians will ned in India, engineers and super- are to be sent to Prague and w for training. The two plants are led to go into production at the f 1963 and the beginning of 1964 ill cost about £82.5 million.

Bhopal unit of Heavy Electricals augurated by the Prime Minister Nov. This plant, for which the tants were AEI Ltd., is already acturing switchgear and trans- s. It is intended that, by 1962, the / will be building traction equip- for the Chittaranjan electric loco- s.

first phase of the project has cost crores and is designed to produce i crores worth of equipment

annually. The second phase of the plant will produce hydro-electric generators and turbines, and has been sanctioned at a cost of Rs26 crores.

AUSTRALIA

Sydney Sales Increase

A 10.8% increase in sales, to a total of 2,664 million kWh, is reported by the Sydney County Council for the year ending 31 Dec., 1959, compared with the corresponding figures for 1958. Although capital income rose by 8%, compared with 1958, to £28.3 million, a deficit of £542,000 was recorded on the year's trading operations. The deficit is attributed to tariff reductions, which became effective on 1 June, 1959, and also to higher cost of electricity purchased. Average price of electricity sold/unit was 2.548d, compared with 2.7d in 1958. Units purchased from the Electricity Commission of NSW amounted to 2,864 million kWh at a cost of 1.619d/unit compared with 1.725d in 1958.

During the year, 11 zone substations with an aggregate installed capacity of 271 MVA were transferred to the Council from the Electricity Commission of NSW. Investigations continued during the year on rating of underground substations in the city area and these have already shown that increase in power output could be obtained with minor alterations to ventilation. An attempt is being made to develop a computer programme for determining rating of the Council's 33 kV cable system. Investigations continued on long-term arrangements for power supply in the inner metropolitan area and these include provision of a new 132/33 kV supply station at Willoughby before 1964 to provide relief for Pymont power station. Aggregate of maximum demands in the Council's area rose to 682.4 MVA.

A total of 860 interruptions to supply occurred during the year with an average interruption time of 69 min. 61% of these were due to weather conditions and 21% to defective mains and apparatus.

Snowy Mountains Contract

Tenders for Murray No. 1 power project will be advertised in 1961 according to the eleventh annual report of the Snowy Mountains Hydro-Electricity Authority, for the year ended 30 June, 1960. During the year, the first phase of the Upper Tumut was completed when the second two 80 MW units were brought into service in September, 1959. Peak supplies were made available to NSW system from the Guthega station and from Tumut 1, which also supplied Victoria. These stations supplied 297 million kWh at 1.1d/unit cost of peak load energy. The 60 MW Guthega station continued to operate on a "run-of-the-river" basis and its generators also frequently operated as synchronous condensers to improve voltage conditions on the State system.

Outstanding progress was maintained on the second phase of the Upper Tumut works comprising the Tooma-Tumut diversion, the Tumut 2 project and the Murrumbidgee-Eucumbene diversion. Almost 15 miles of major tunnels were excavated, Tantangara Dam was completed and substantial progress made on the Tooma and Tumut 2 dams. At the end of the year, excavation of the large Tumut 2 underground power station was almost completed. Progress was so rapid that extra funds were required and an additional sum of £2.65 million was made available, bringing the authorities appropriation for the year to £28.25 million. 1959 also saw adoption of the modified arrangement for the Snowy-Murray section. As we reported earlier this year, a surface layout has now been decided upon for the first of the Murray power stations. Development work was carried out during the year on a hollow-core type bolt, said to be easier to install and simpler to grout than previous constructions. Investigations also began on the use of epoxy resins both for concrete repair work and for improving the bond between reinforcing steel and concrete. The investigations have given promising results and epoxy resin was used to carry out repairs to damaged concrete in the Eucumbene-Tumut tunnel.

Hydro-electric Potential

Investigations carried out in recent years by the hydro-electric commission at the Pieman River were recently commented on by Mr Reece, the Premier. He said that the investigation had shown the tremendous potential for hydro-electric development existing on the west coast of Tasmania, where there were four rivers serving an area with an average rainfall of between 80 in. and 100 in./annum. It was possible that development of these resources would revive interest in the west coast mining industries. However, for the next few years, resources available for construction would be concentrated on the Poatina scheme and it would not be until this project was nearing completion that funds could be applied to development of the west coast hydro resources, which was likely to cost about £50 million.

High Consumer Connection

Of the 105,000 people living in the area supplied by the Townsville Regional Electricity Board, 91% are now connected to the supply. Announcing this recently the chairman of the board, Mr J. A. Sherriff, said that more residents would receive electric power before the end of the year. At present, the major extension scheme is to be in the Woodstock, Major's Creek area at £40,000 and in the Don and Gumlu areas. Connecting residents in the Black River and Bluewater Creek districts is also in hand at a cost of £20,000. Land clearing has begun for extensions in the Broughton River area where a number of citrus farmers will be connected.

Personalities *in the industry*



Mr F. R. Mason



Miss P. E. Grady



Mr F. O. Brown



Mr H. Etchells



Mr H. R. Parkin

The export company of Associated Electrical Industries Ltd., AEI Export Ltd., which was formed last year, now has a single managing director instead of three joint managing directors. The change took effect on 1 Nov. Appointed managing director of the company is **Mr F. R. Mason**, B.Sc.TECH. **Mr E. V. Small**, who was one of the three joint managing directors, has retired from executive work with the export company and is appointed consultant. **Mr H. West**, M.Sc., M.I.MECH.E., M.I.E.E., who is managing director of AEI (Manchester), becomes also a director of the export company; and **Mr B. A. Hensler**, one of the previous joint managing directors, will continue as a director.

Mr D. G. Nairn, O.B.E., is to relinquish his position on the board of J. and F. Stone Lighting and Radio Ltd., following the annual general meeting on 24 Nov. "in order to make room for a younger man and to relieve his own commitments." Mr Nairn has been chairman of the company for 12 years. It is anticipated that **Mr F. Stanley Bassett**, who became a director last April, will succeed him as chairman.

Mr Ernest Long, a member of the Central Electricity Generating Board, is now on a two-week "Meet the People" tour of Ghana and Nigeria as President of the Chartered Institute of Secretaries. He is accompanied by **Mr J. Phillips**, secretary of the Institute.

Morphy-Richards Ltd. are soon to have their own team of demonstrators. As the first step in the implementation of their new policy, **Miss Phyllis E. Grady** has been appointed housecraft adviser/home economist to the company, to assist in the development of new products and in the general promotion of appliances. She will also engage, train and manage a team of lady demonstrators who will promote M-R domestic electrical appliances throughout the country. Miss Grady, who has been associated with the electrical industry for 20 years, was previously senior demonstrator with the London Electricity

Board and has close associations with the EAW and EDA. In 1949 she was awarded the Electrical Housecraft Advisers' Diploma, and in 1956 won the Caroline Haslett Travelling Exhibition and toured Sweden for three months, studying domestic electricity. She has also visited the United States, Canada and a number of European countries.

Mr P. B. H. Brown has been elected chairman of Worthington-Simpson following the retirement of **Sir Samuel R. Beale**.

Previously deputy station superintendent at Hams Hall "A," "B" and "C" power stations, Midlands Division, CEGB, **Mr F. O. Brown**, A.M.I.E.E., has now been promoted to station superintendent there in place of the late **Mr J. Paxton** (*ESH, page 66). Mr Brown started his career in the industry as a trainee at Summer La power station of the City of Birmingham Electric Supply Dept. Later he transferred to Aston power station as a switchboard attendant and then went to Nechells Princes station as a control room engineer. In 1926 he became boiler house shift engineer at the latter station, and three years later was appointed shift charge engineer at the Nechells temporary station, returning to Nechells Princes in 1930 as assistant system control engineer. Mr Brown was transferred to Hams Hall "A" power station in 1946 as combustion engineer, promoted to deputy station superintendent there in 1947, and to station superintendent in 1955. In July last year he became deputy station superintendent of the Hams Hall "A," "B" and "C" stations.

After 52 years in the electrical industry, **Mr H. Etchells**, of AEI Lamp and Lighting Co. Ltd., has retired. He had been Preston area manager until January, 1959, and since then had been acting in an advisory capacity to the company. A native of Manchester, he started his career in the industry in 1909. He had been with BTH and AEI for 37 years. When AEI took over the lamp and lighting departments of the BTH Co.,

Metropolitan-Vickers and Edison Swan, Mr Etchells was appointed area manager and from there he went to Preston. At a recent ceremony he was presented with an electric fire and an electric blanket from his colleagues.

Mr H. R. Parkin, A.M.I.E.E., has been appointed chief engineer of the Meter Department of English Electric's Meter, Relay and Instrument Division at Stafford. He will be responsible for all engineering aspects of single and poly-phase electricity meters and other auxiliary equipment. Mr Parkin received his early training at Measurement Ltd. and joined English Electric in 1937. From 1944 he was a design and development engineer in the Meter Laboratory and in 1955 was appointed chief meter development engineer. He was educated at Stafford County Technical College.

Colonel H. A. Lewis has relinquished his appointment as managing director of EMI Sales and Service to take up the appointment of managing director of Newmark (London) Distributors Ltd.

At the inaugural meeting of the new session of the Royal Society of Arts last week, **Sir Christopher Hinton**, chairman of the CEGB, and **Sir William Holford**, part-time member of the Board, were awarded silver medals for their papers on "Power Production and Transmission in the Countryside: Preserving Amenities." The papers were given to the Society a year ago.

Mr V. H. Devis, formerly N.E. London area representative for Dowding and Mills Ltd., has been promoted to the position of assistant manager of their Southampton branch. **Mr J. Evans** will take over the duties of N.E. London area engineer representative.

Mr D. Wilkie, of Large Electrical Machine Sales, Heavy Plant Division, Rugby, of Associated Electrical Industries Ltd., has retired after over 41 years' service.

* Denotes revision to the "Electricity Supply Handbook, 1960."

accountant of the South Western Board since 1948, **Mr C. E. Knight**, F.I.M.T.A., F.S.A.A., will, in addition, as adviser for the Board's Mid Somerset group of districts, succeed **Mr E. H. Sherrin** (*ESH, page 98). In his new group adviser he will advise managers throughout Bristol and on all aspects of Board policy. A Cornishman by birth, Mr Knight was an accountant for a number of years in the early years of his career. He was appointed deputy treasurer of Swindon in 1942 and was later treasurer of Hampstead in

1947. He is now head of the Member Relations Department of the Electrical Research Council, **Mr W. H. Devenish**, is now returning to India. In New Delhi he will attend the plenary meeting of the Inter-Regional Electrotechnical Commission, as the chief British delegate to the technical committee on insulating materials (T.C. 15). As chairman of the Group of this committee on the subject of Test for Electric Strength, he is to hold a meeting of the Group in London with comments on a draft covering all solid materials. He will also be attending corresponding international meetings concerning liquids, with which he is associated. Following the IEC meeting, Mr Devenish will take the opportunity of visiting existing and potential markets for the ERA in India. An excursion has been arranged which will include Faridabad, Bhopal, Calcutta, Madras, Coimbatore, Mysore, Bombay and Baroda. At the end of his visit he will address the local centre of the Institution of Engineers (India) on the subject of the ERA. He is due to return to Britain at the beginning of December. **J. Pache**, A.I.M.E.C.H.E., has been appointed station superintendent at the new Dock power station, North Wales. He succeeds **Mr P. H. G. Jones**, A.M.I.E.E., who is now station superintendent of the Region's Trawsfynydd nuclear station under construction in North Wales (*ESH, page 74). Mr Pache is aged 36, was previously station superintendent at Clarence Pier power station for two years at Croydon. He entered the electricity supply industry in 1952, gaining experience at King's Wharf and Fulham power stations, and in 1955 was appointed



Mr C. E. Knight



Mr W. H. Devenish



Mr N. J. Winnett

boiler house charge engineer at Kirkstall station, Leeds, and in the following year became shift charge engineer at Blackwall Point. Mr Pache studied at Acton Technical College and gained early experience with Rotax Ltd., where he was later engaged on electrical testing and development work on i.c. engine starters and controllers. From 1946 to 1948 he was technical sales engineer, dealing with preparation of specification and inspection of machine tools and diesel engines, and after a further period on planning and co-ordination of manufacture of aero engine equipment was an erection engineer on power station boilers from 1950 to 1951. There followed a short period as assistant production manager with a small engineering firm before he came into electricity supply.

Formerly chief engineer of McLeod and Co., of Calcutta, **Mr A. B. Aston** has been visiting Britain prior to returning to India this autumn as senior electrical and mechanical engineering executive at the Calcutta head office of International Combustion (India) Ltd. He is also to represent South Wales Switchgear Ltd. in India.

Mr Duncan W. Low, B.Sc., A.R.T.C., M.I.E.E., A.M.I.C.E., has retired from the position of managing director of Duncan Low Ltd., but is to remain on the board as chairman. One of the pioneers of electric water heating, he made his first heater in 1914 at his father's firm of Archibald Low and Sons Ltd. In 1926 he patented the side-entry circulating immersion heater, still among the most popular types in Scotland. He is succeeded as managing director by **Mr D. R. Laphorn**, his brother-in-law.



Mr J. Pache



Mr Duncan W. Low



Mr D. R. Laphorn

Manager of the Appliance Design Centre of the GEC at Wembley since April, 1959, **Mr N. J. Winnett**, B.Sc., has been appointed manager of the firm's Swinton works, where he has already had considerable experience. Mr Winnett entered the company's Magnet Wks as a trainee in April, 1947. Within a year he was given charge of the Sheathed Wire Element Shop at Magnet Wks and was later transferred to the company's Swinton Wks to manage the hotplate shop. In July, 1948, he was appointed chief inspector at Swinton and, four years later, took charge of design of all technical matters and was given the title of technical manager, a position he held until last year.

Mr N. R. Munro has been appointed sales manager of Duncan, Partners and Price Ltd.

Mr L. H. Coley has been appointed joint managing director with **Mr F. Leighton** of Warbrick (Engineering Specialties) Ltd.

Mr R. R. Kennan, A.M.I.M.E.C.H.E., has accepted an invitation to join the board of Ferry-Diamond Engineering Co. Ltd. He will still retain his directorships of Mono Pumps Africa (Pty) Ltd. and Mono Pumps (Australia) Pty Ltd., also the general sales managership of Mono Pumps Ltd., of London.

The Minister of Power has appointed **Sir Hamish D. MacLaren**, K.B.E., C.B., D.F.C., LL.D., B.Sc.(Eng.), M.I.E.E., and **Sir Vincent Tewson**, C.B.E., M.C., as part-time members of the London Electricity Board (*ESH, page 75). Sir Hamish only retired at the end of last month from the position of Director of Electrical Engineering, Admiralty, and is currently president of the IEE, while Sir Vincent was until recently general secretary of the Trades Union Congress and has been a member of the Economic Planning Board since 1947.

Nominated as deputy director of the CEB's Berkeley Nuclear Laboratories is **Dr A. Trevor Churchman**, Ph.D., B.Sc., M.Inst.Metals, M.I.N.E., who joined the Board last year as head of the Materials Division of those laboratories. He retains the latter appointment and also assumes the additional responsibilities of deputy director (*ESH, page 49). Dr Churchman was born and educated in Birmingham at King Edward's School and later at the University. After obtain-

ing his B.Sc. first class Hons. in physical metallurgy in 1946 he went on to obtain his Ph.D. in 1949 and was elected a University Research Fellow the same year. In 1951 Dr Churchman joined the AEI Laboratories at Aldermaston, and from 1955 to 1958 was attached to Professor Cottrell's Irradiation Study Group at AERE, Harwell. In 1957 and 1959, Dr Churchman made lecture tours of the USA, and has had numerous articles published in the scientific journals.

Mr J. Bertram, B.Sc., has been appointed manager of the newly formed Systems Department at the Leicester headquarters of AEI Lamp and Lighting Co. Ltd. This department embraces responsibility for the introduction of electro-data processing, development of operational research, organisation methods and service on statistical problems. Mr Bertram graduated from Glasgow University and joined BTH, Rugby, as a student apprentice. He was one of the original members of the Motion Study Society of Gt. Britain, which has now developed and joined with the former Society of Industrial Engineers to form the Institute of Work Study. In 1954 he visited America as a member of the NATO Electronic Team. Since 1958 he has been personal assistant to the director of manufacture.

Mr N. T. Atkinson, formerly head of Ekco television development, has been appointed to the post of chief of television and radio development. Mr Atkinson has been concerned with the development of Ekco television receivers since 1938 and in his new position he will be directly responsible to executive director and chief engineer Mr A. J. Brunner. Mr E. W. Maynard, formerly in charge of export television development, succeeds Mr Atkinson as head of television development.

Senior appointments in their Development and Engineering Group are announced by the UK Atomic Energy Authority. Mr R. V. Moore, G.C., formerly director of reactor design, and Dr H. Kronberger, O.B.E., previously director of research and development, have been appointed as deputy managing directors. Mr P. T. Fletcher, C.B.E., B.Sc., A.M.I.MECH.E., will be deputy managing

director, general management. Mr Moore will be deputy managing director, projects, and Dr Kronberger, deputy managing director, development. Mr S. Fawcett, previously deputy director, has succeeded Mr Moore as director of reactor design. In addition, the Research and Development Directorate at Risley has been divided into two executive directorates. Dr H. K. Hardy and Mr F. W. Fenning have been appointed, respectively, director of fuel element development, and director of reactor technology (*ESH, page 182).

The Saunders Valve Co. Ltd. announce that while remaining a joint managing director with Mr A. L. Trump, Mr P. T. Stephens has been appointed deputy chairman. Mr P. C. E. Rose, an executive director of the company, has been appointed general manager of the industrial divisions.

Mr G. A. Flume of Carrier International Ltd., returns to America this week after six months in London as technical advisor to Carlyle Air Conditioning and Refrigeration Ltd.

Mr J. Boardman has been appointed chairman and chief executive of the Burtonwood Engineering Co. with effect from 14 November. He was formerly deputy to the present chairman, Mr R. Dutton Forshaw, who resigns from the board from that date.

OBITUARY

Mr M. V. Ratcliffe, B.Sc.(ENG.), M.I.E.E., M.CON.S.E., consultant to Kennedy and Donkin, died recently in an air accident in Brazil while on a temporary mission in connection with a survey his firm are undertaking for the Brazilian Nuclear Energy Commission.

Mr A. V. Hewitt, who died last week aged 64, had been associated with Giffens Ltd. of St. Albans since 1912. Prior to retiring some four years ago, he was the contract supervisor and a director.

Sir Ernest Woodhouse Smith, C.B.E., D.S.C., F.R.I.C., F.INST.FUEL, died on 7 November aged 76. He had been associated with the solid fuel and gas industries, and was president of the Institute of Fuel in 1943-45 and president of the Smoke Abatement Society in 1953-54.



To mark the retirement of Mr J. C. Stewart from the managership of the Glasgow and district branch office of George Ellison Ltd., a silver tea service was presented to him by his colleagues on the sales staff. Our picture shows Mr G. J. R. Ellison (right), joint managing director and grandson of the founder of the company, making the presentation

NEW LITERATURE

The Relay Guide

by R. N. Auger

THERE are many manufacturers in Britain who will welcome this compendium in which about 1,000 of the latest designs of relays manufactured in America are illustrated and described. Every day, almost, sees the appearance here of a previously unknown type, either as part of an electrical assembly or as a reference in an overseas specification for which tenders are being prepared. Even as we were perusing its contents we received a telephone message asking if we had heard of a relay bearing the number AH23CN460AA. We hadn't, but in a few minutes we were able to turn up dimensional details, performance, type, test specifications and maker, all of which were passed on to a vastly relieved inquirer.

It will find a ready place on the bookshelves of electrical component manufacturers and others, particularly in the aircraft industry, but, unlike so many reference books, it will frequently be consulted. There is a need for a companion volume on British relays. Published by Chapman and Hall, 360 pages, 11 in. by 8½ in. Price 80s.

Photoconductivity of Solids

by R. H. Bube

THE study of photoconductivity can be said to have commenced with the discovery by Willoughby Smith, a telegraph company electrician, that a bar of selenium altered its resistance when exposed to light. This he reported in a contribution to *Nature* in 1873. For the next 50 years little further attention was given to the subject, though in 1879 E. H. Hall noted a potential difference in a material carrying a current, but at right angles to the flow, when in a magnetic field—the now well-known "Hall effect."

Serious study of these and allied phenomena can be said to start with the work of Gudden and Pohl in 1920, Demmer in 1931 and others, after which both the field of investigation and the number of researchers expanded rapidly.

The exceptional progress made in another field, that of semiconductor applications, in the 1950's gave added impetus and a number of scientists in universities and industrial laboratories made photoconductivity their specialised study. One of these was Dr Richard H. Bube who joined RCA Laboratories in 1948 and who has concentrated on this work ever since. He now sets down the fruits of his labours in a textbook of exceptional interest and authority. As a comprehensive analysis of photoconductivity effects, it ranks among the more important additions to technological literature. An appendix lists no less than 1,009 references which, in itself, is almost a directory of research workers in this field. Published by Chapman and Hall, 456 pages, 9 in. by 5½ in. Price 118s.

Potential dividers for field supplies

by a correspondent

THE advantages of potential divider supplies for the field circuits of many machines, especially small experimental ones, are that field control is available over the whole range from zero to the maximum, and that there is no need for any special field discharge resistance: the divider arrangement, Fig. 1 ensures that the field circuit is never broken. To give smooth control of the field current, the divider preferably a tubular slider rheostat rather than a stud rheostat with a rotating arm. Unless the maximum field current is under about two amperes, a tubular rheostat used as a potential divider supply will have to be graded, i.e., composed of several sections of resistance of different current ratings, lest it otherwise need the wire of the maximum rating than can be accommodated on two of the longest tubes available. The problem of designing such a graded rheostat is discussed in the rest of this article.

Current Flow in Divider

In a smoothly graded potential divider the "through current" I_t , traversing the divider beyond the tapping point, is constant: the load current I_l decreases as the tapping point is moved down from the full-voltage setting, so that the total current I , traversing the divider to the tapping point, also decreases. In theory, the current rating (and hence the cross-section) of the divider resistance wire can be continuously reduced from top to bottom; and if the reduction be such that the wire rating is always equal to the total current at the tapping point, the shortest divider will be obtained for the given through and maximum load currents. If these currents are equal, the shortest possible wire will be obtained. The wire rating varies smoothly from the sum of the through and load currents at the top to the through current alone at the bottom.

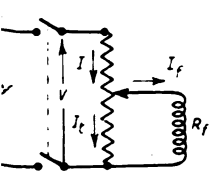


Fig. 1. In a smoothly graded potential divider, the load current I_l beyond the tapping point is constant. The current I therefore varies with field current I_f .

In practice, to use a tubular sliding rheostat of reasonable length as a potential divider, it may have to be graded; it must then be wound with a number of steps of wire of discrete ratings. The practical problem thus reduces to one of finding the shortest tube possible for given requirements, using a sequence of standard resistance wire ratings. The procedure for doing this is given.

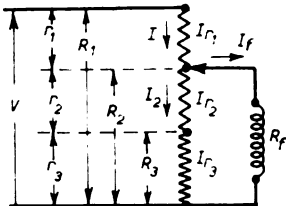


Fig. 2. Potential divider with three grading steps. Step resistances are r_1 , r_2 and r_3 . Total resistances are R_1 , R_2 and R_3 .

The criterion is that at the top of each section of wire rating I_r , the sum of the load and through currents, $I_l + I_t$, is equal to I_r . A three-stage divider in which this condition is met is shown in Fig. 2, in which I_{r1} , I_{r2} , I_{r3} , are the ratings of the steps; R_1 , R_2 , R_3 , the total; and r_1 , r_2 , r_3 , the step, resistances.

R_t is given by $V/I_{l \text{ max}}$.
and R_l is given by V/I_l .
where I_t is chosen as roughly equal to $I_{l \text{ max}}$.
 I_{r1} is $I_t + I_{l \text{ max}}$ so that the top few turns shall be almost fully loaded when the slider is near the top. I_{r2} and I_{r3} are the next smaller available ratings.
 R_2 is obtained by remembering that parallel currents are in inverse relation to their resistances.

I_t is $I_{r2} - I_l$, whence
 $R_2 = (I_{r2} - I_l)R_t/I_l$.
Similarly, $R_3 = (I_{r3} - I_l)R_t/I_l$.
and similarly for any further available grades, for I_{rn} need be little greater than I_l .

Choosing Divider Size

Total resistances having been obtained as above (tabular computation will save time and space) the steps r_1 , r_2 , etc., for each rating are found by successive subtraction. From tables, the "ohms per inch" on tubes wound with wire of each rating may be deduced, whence the length of tube occupied by each step found by division; and the total length of tube required found by addition. The accompanying table shows specimen calculations for a 2 A load and 2 A through current.

Specimen Calculation:

$V = 200$ volts. $I_{l \text{ max}} = 2.0$ amp so $R_t = 100$ ohms.
 $I_t = 2.0$ amp so $R_l = 100$ ohms and $I_{r1} = 4.0$ amp.

I_r amp.	$I_t = I_r - I_l$ amp.	$R = R_t I_t / I_l$ ohms	r ohms	ohms/in. at I_r	Length occupied in.
4.0	2.0	100	50	3	16.7
3.0	1.0	50	25	6	4.2
2.5	0.5	25	25	8	3.1
Total length					24.0 in.

This 24 in. tube is rather long. However, it is worth trying to shorten the required length by reducing the through current (and under-running the top section) to enable lower-rating wire, with more ohms per inch, to be used at the bottom. To this end, a trial may be made with I_t at 1.5 A, and a section r_4 of 2.0 A wire of 12 ohm per inch on the tube. The working (not shown) gives a length of 23.9 in., so this trick seems hardly worth it—but be assured that it may be!

Since the writer has not seen anything published on this subject—hence the evolution of the above procedure to satisfy an urgent requirement—he concludes by asking anyone with a more elegant procedure to offer it for publication.

European Power Plant Survey

DESPITE a falling off in demand for boilers and transformers during 1959, the overall position of manufacturers of power plant and equipment in Europe remained exceptionally healthy, new peaks in deliveries of alternators and water turbines more than compensating for the drop in the static equipment. This view is expressed in an OEEC survey published last week. The indication of a reduction in new hydro-electric schemes in Europe, forecast in the previous survey, appears to be confirmed since the flow of new orders was substantially lower than in 1958. Another factor has been the completion of production facilities for boilers in non-OEEC countries, which naturally lowers the demand from member countries. Installations made in non-member countries have, for the first time, exceeded 10,000 t/hr.

Deliveries of steam turbines, alternators, boilers and water turbines, taken together, were up by about 20% on 1958 figures, while alternators for coupling to water turbines not manufactured by member countries rose by 10%. Shipments of transformers fell by 10%. Exports of rotating plant to third countries increased considerably faster than those to member countries.

Deliveries of alternators up to 40 MW remained at about the same level, totalling 2,150 MW as against 2,136 MW in 1958. Alternator deliveries of 40 MW and over rose by 1,830 MW to a new record figure of 9,337 MW, despite delays accounting for as much as 1,791 MW. Orders in hand suggest that a further rise is due in 1960 and shipments of over 11,400 MW are being planned. Total book orders as at 1 January, 1960, amounted to 30,033 MW an increase of 2,274 MW.

Turbines up to 40 MW totalled 2,203 MW but are expected to fall to 1,765 MW in 1960, the lowest figure since 1949. New orders were down 515 MW at 1,688 MW. Against this, the shipments of turbines over 40 MW was up 1,653 MW to a new peak of 8,612 despite a number of late deliveries totalling 1,830 MW. Orders for 1960 indicate that this peak will be passed since deliveries due in the year now total 10,630 MW.

Boilers up to 180 t/hr fell by more than 3,000 t/hr, continuing the drop recorded in previous years since 1952, and a further decline is anticipated. An increase of 8,890 t/hr to 27,818 t/hr in larger boilers was a new peak but shrinking order books tend to show a falling off for future years.

Total installations of nuclear reactors amounted to 155 MWe, 20 MWe above 1958, and a total of 2,247 MWe scheduled for completion in the next four years includes three more reactors totalling 372 MWe.

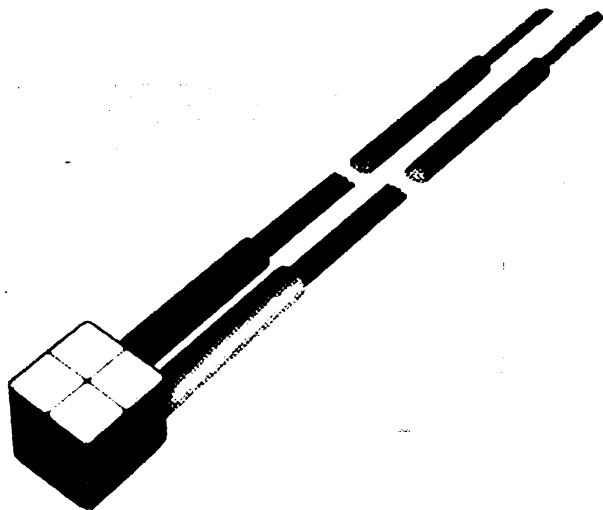
Gas turbine deliveries in 1959 were 69 MW more than estimated at 416 MW with order books indicating a similar programme for 1960. Alternators for use with non-members water turbines reached a new record of 5,323 MW despite arrears at the beginning of the year of 737 MW. New orders are down 1,218 MW at 4,105 MW. Water turbines of 10 MW and over are again a new record at 6,801 MW but order books show the expected drop by 893 MW to 5,908 for 1960, totals having shrunk from 17,022 MW to 14,295 MW.

Though deliveries of power transformers over 5 MVA dropped by 7,888 MVA to 51,427 MVA, orders booked for 1960 were 4,151 MVA up on 1959 figures.

Thermo-electric cooler in production

FIRST of a range of thermo-electric cooling units to be marketed by a British manufacturer has been introduced by Salford Electrical Instruments Ltd. (a subsidiary of GEC) following an extensive research programme at the GEC's Wembley laboratories.

Based on the Peltier effect, the cooling capacities of the units vary from less than 1 W for a single-junction type to more than 10 W for a large multiple junction.



Four-block 1 W Peltier cooling unit for electronic applications

They thus cover a range which cannot be conveniently dealt with by conventional means of refrigeration.

The first of the group to be readily available is the BT.4, a four-junction unit with a cooling capacity rated nominally at 1 W, although the rating can be increased with a resultant reduction in temperature depression. Alternatively, a greater temperature depression can be achieved by reducing the rating.

The BT.4 is made in the shape of a small cube, and thermal junctions are formed by a combination of "p" and "n" types of a bismuth telluride semiconductor material. In use, the block is clamped between the object to be cooled and a heat sink. Typical of its many applications is the cooling of electronic components which must operate in high ambient temperatures, when it serves to increase the power ratings of transistors, reduce the dark current in photo-transistors, or—in the case of quartz crystals—to allow operation at the inversion point or other selected part of the frequency deviation/temperature characteristic.

Other applications are with laboratory equipment such as microtome knives or microscopic slides where local cooling is essential; with instruments such as dew-point hygrometer heads where thermo-electric cooling involves changes in techniques and resultant simplification in the equipment; and with the cooling of small volumes by incorporating one or more units into the walls of a chamber. Here, the temperature may be held constant by a proportional controller which allows smooth regulation of the cooling rate via the d.c. current applied.

PROBLEMS AND PRACTICE

acing Bearings

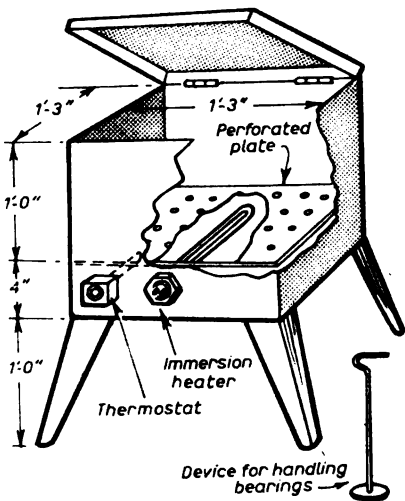
he maintenance of machinery, particularly electric motors, it is often arly to remove ball and roller bear- from the shafts and to replace them w ones.

the majority of cases, by the use table pullers which can be made ough in a variety of patterns, al is not a particularly difficult . Several of these devices have described in these pages from time e.

replacement of bearings, particu- large ones, is not always possible rely mechanical methods for most rs" are not suitable for pushing. is always a risk of distorting the races where diametrical tolerances use.

ting of the bearing is often suc- providing that the heat is evenly d and the temperature is not higher necessary since all ball and roller gs must be regarded as precision- close tolerance devices. If not expansion is required, a tungsten at lamp inserted in the bearing be effective if rather slow. A and more rapid method is to etely immerse the bearing in hot il oil.

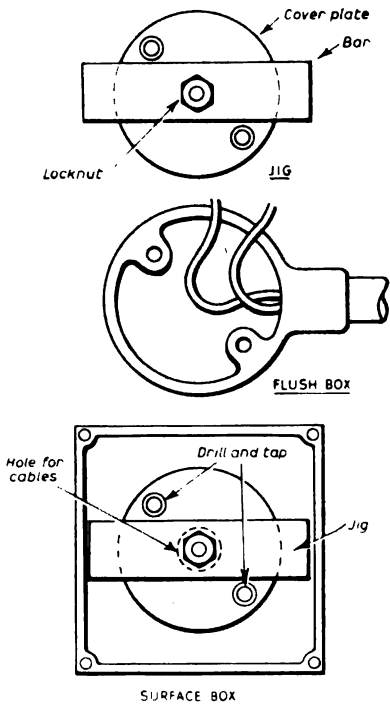
as horrified to observe, on enter- workshop one morning, a drum ning about ten gallons of light e oil being heated by a blowlamp is purpose. Already a blue vapour rising from the surface and it was that no one had considered either anger of the oil approaching its point or the upper limit desirable the point of view of the bearings. ckly putting a stop to the practice. oceeded to contrive an electrically l and thermostatically controlled nk which is depicted here. The g element and thermostat are of intended for installation in domes- t water tanks and were available stock. This was successful for its e and eventually a number were for other workshops where they l invaluable, not only because the of fire was eliminated, but also e the temperature could be more / controlled at the desired level. l be appreciated that, with the ostat chosen, the oil temperature t rise above 100°C but, as a d rule, a lower temperature is ate for the purpose. The presence oil film also facilitates fitting of aring.—F. J. Halligley.



An easily made oil heater for expanding ball and roller bearings prior to fitting

Jig for a Jack

A SHORT while ago I was engaged on a task which called for the fixing of a number of 3 in. by 3 in. by 2 in. surface boxes, each housing a jack



The simple jig, shown above, enabled the fixing holes to be drilled correctly in the square surface boxes for attachment to the circular sunk conduit boxes

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

socket, to existing sunk boxes. The normal fixing holes on the sunk boxes to take the cover screws lay, through the positioning of the boxes themselves, at different angles. My problem was to drill the surface boxes to take the fixing screws in such a way that all of them were square with the floor when in position.

The first step was to drill a hole in the centre of the square boxes to admit the cables from the sunk box. The position of this hole was readily determined by drawing diagonals across the back of the box. Similarly, the jack socket was fitted in a hole central to the cover of the box. The next step was to prepare a jig for transferring the fixing hole positions in the sunk box accurately to the surface box.

A circular lid was taken and drilled centrally to accommodate a fair sized nut and bolt. To this plate was attached a piece of metal strap, drilled central to take the bolt and with squared-off edges, just wide enough to enter the surface box (see diagram). With the jig in place on the sunk box and the screws inserted in the two fixing holes, the strap was turned to the horizontal (or vertical) position and fixed by tightening the nut. The fixing screws were next removed and the jig transferred to the surface box with the bolt head in the central hole. The fixing holes in the circular plate were then used to drill the surface box which, when finally screwed in place on the sunk box, was square as required. The cable hole was then bushed, the cables fished through and attached to the jack socket connections. The final step was to affix the plate to the box by the corner screws provided.

This simple device, which only took a few minutes to construct, saved a lot of time in marking-off and ensured that all of the boxes were square in position.—J. H. Robinson.

'Ware Condensation

THE proposal to prevent the entry of plaster and debris into conduit by corking the tube ends (page 179, 4 Aug.) appears sound enough, but we prefer to get the apprentice to shape circular tapered wood plugs in his spare time and to hammer them in place in a tight fit. This prevents withdrawal by curious fingers.

In either case one should guard against the corroding effects of condensation. The cork or wood plug should be removed some time before the wires are drawn in to allow for free circulation of air.—"Michet."

for the electrical trade

Tube diffuser price cuts

PPRICE reductions on kW diffuser attachments for use with Super Slim "Popular Pack" fittings are announced by Atlas and Ekco-Ensign. The 8 ft model is reduced from £4 14s 8d to £3 11s, the 5 ft from £2 19s 2d to £2 7s 4d, the 4 ft from £2 10s 11d to £2 2s 7d and the 2 ft from £1 15s 6d to £1 9s 7d. All prices include purchase tax. Effective from 3 Nov. *Atlas Lighting Ltd., Thorn Hse, Upper St. Martin's La, W.C.2; Ekco-Ensign, 45 Essex St, W.C.2.*

Another Pakamac 'fridge

LATEST appliance from the new Pakamac factory is a 2.5 cu ft absorption type refrigerator, "Pelican." It retains several features of the 4 cu ft model which appeared earlier this year, notably the melamine table top and raised panel at the rear, bearing thermostat control and outlet grille. The interior, of blue or lilac polystyrene, includes two sliding shelves, removable egg rack and a large freezing compartment with an attractively styled flap.

The new refrigerator and the 4 cu ft model, which has been available so far only in the north, will both be distributed nationally in 1961. Price of "Pelican," Pakamac 250, is £46 4s tax paid. Dimensions: 35 in. high by 21 in. wide and 23½ in. deep. *Pakamac Special Products, Melbourne Mill, Chadderton, Lancs.*

Moffats' oven prices

CONSIDERABLE reductions in prices of built-in ovens by Moffats are announced. Top models now sell at £99 15s instead of £118 and less expensive versions have been reduced proportionately. *Moffats Ltd., 1 Newman St, W.1.*



TRADE PUBLICATIONS

LJUNGSTROM.—Annual report for 1959 and pamphlet describing the development of the Ljungstrom turbine in Sweden from De Laval Ljungstrom (Gt. Britain), 129 Kingsway, W.C.2.

M.K.—Catalogue of electrical accessories for 1961. M.K. Electric Ltd., Shrubbery Rd, Edmonton, N.9.

W. AND G.—1960-61 comprehensive catalogue of electrical accessories, cables and flexibles and price-list. Ward and Goldstone Ltd., Pendleton, Salford 6.

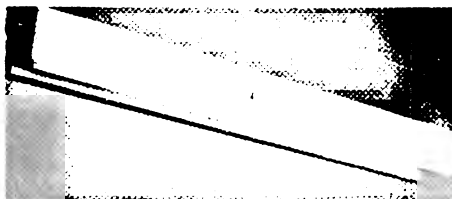
CEILINGS.—Large brochure on ceiling design using luminescent sections and acoustic tiles—components, design and construction. Courtney, Pope (Electrical), Amhurst Park Wks, Tottenham, N.15.

Mercury fluorescent prices

THE announcement of a considerable reduction in the price of "Mazda" 250 W mercury discharge fluorescent lamp follows similar alterations by Philips and Stella which were noted in last week's issue. This lamp, Type MFB/U, is now priced £4 4s list—a cut of 15s. *AEI Lamp and Lighting Co., Melton Rd, Leicester.*

Ceiling fitting becomes wall light

A SIMPLY installed diffuser attachment for use with the Super Slim "Popular" tube fitting turns the unit into an attractive wall light. It is a right-angled section of Perspex which can be fixed over the fitting without any extra screws or accessories. The new attachment, "Pin-up," allows direct downward illumination in the wall mounting position as well as diffused light upward and outward, which should prove ideal in



▲ "Pin-up," the attachment that turns a "Super Slim Popular" fitting into a wall-light

▶ "Twindry" and "Popular," low-cost dryer and washing machine fit together to form a tandem totalling £33 12s tax paid

◀ "Pelican," the second 'fridge from Pakamac. A 2.5 cu ft model selling at £46 4s

alcoves or over bathroom mirrors. "Pin-up" sells at £1 2s 6d, tax paid, for the 2 ft model and £1 11s 11d, tax paid, for the 4 ft. A cord switch is available with it as an optional extra, 8s. *Atlas Lighting, Thorn Hse, Upper St. Martin's La, W.C.2.*

Night-storage heater

A 3 kW heater has been added to the "Nightstor" range of storage block heaters. Like the earlier models, it is designed to occupy the minimum of floor space, having a false back to enable it to be installed as close as possible to the wall. Finished in hammered bronze, the new "Nightstor" HQ 6330 sells at £22 5s. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*

Dish-washer improvement

A NEW version of the "Dishmaster" dish-washing machine is to be added to Kenwood's range. It differs from the existing models in that it includes an electric water pump and requires no plumbing. The user simply attaches an inlet hose to the water tap and places the end of the drainage pipe in the sink. The new "Dishmaster" needs no exclusive floor space and can be pushed out of sight after use. The pump system is of the centrifugal type, powered by a fan-cooled shaded-pole motor.

One of the earlier models, the Semi-Automatic "Dishmaster," has been modified slightly to include a lid-locking device to prevent the lid being opened whilst the unit is in use. Prices of the machines are Fully Automatic "Dishmaster" with pump, £133 7s tax paid; Semi-Automatic Standard Model, £76 13s tax paid. *Kenwood Manufacturing (Woking) Ltd., Woking, Surrey.*

New spin dryer

A SPIN dryer companion to Brunlec's low-cost "Popular" washing machine is announced at £21. The new dryer, "Twindry," is identical in dimensions to the washing machine and the two can be fitted together to form a tandem unit. It features a transparent plastics lid incorporating the usual safety brake. "Twindry," like the washer, is available in white or cream and can be supplied with a table top at £1 1s extra. *Brunlec Appliances, Junction Mills, Junction St, Burnley.*



equipment for industry

Temperature indicator/controller

FINING the functions of a remote indication thermometer and temperature controller, a new addition to the "Bikini" range of instruments give quick response even when at long distances from the point of element or control. Temperature indication is by means of a servo-motor pointer and the instrument is used in conjunction with a platinum-resistance thermometer. Connection is made by an ordinary cable lead which can be up to 100 ft. long. A choice of 73 temperature points is available, from -200°C to $+100^{\circ}\text{C}$.

A separate lead connects the instrument to a relay which operates changeover normally open contacts rated at 10 A. The relay can be arranged to operate at a predetermined temperature by means of a control pointer on the dial of the instrument. Fully transistorised, the instrument reads to 0.5% and can be powered from standard mains supply or 24 V d.c. *Fielden Electronics Ltd., Shawhe, Manchester.*

Calibrated shaded-pole motor

IGNED to meet Ministry of Aviation specification DTD 1085/B, a tropicalised shaded-pole motor is available, of which there are two sizes. One is continuously rated at 100 W gross with 2 W output, the other at 100 W gross with 12 W output. Full speed is 2,700 r.p.m. at 50 c/s and five field connections are provided for either 230 V or 115 V. Typical applications are cooling blower drives for electronic equipment working under adverse weather conditions and chemical mixers in aggressive atmospheres. The motor is reasonably priced. *British Vacuum Cleaner and Engineering Co. Ltd., Goblin Wks, Leather Surrey.*

Drilling anchor-bolt

MPLE but effective means of attaching heavy equipment to masonry or concrete is provided by a self-drilling anchor-bolt used for some years in the U.S. and now available in this country. The bolt is self-drilling and having specially hardened and hardened cutting teeth, the first driven into the masonry by a pneumatic hammer. It is then driven, a hardened-steel taper-plug is driven into the open end and the bolt is redriven into the original drilled hole. The end of the bolt is belled out by edge action and the ridged sides are solidly embedded in the masonry. It is claimed that tests carried out for

medium concrete show that anchorage provided was greater than the sheer resistance of the concrete material. A variety of types can be supplied, such as stud-end, hanger or tie-rod, in sizes ranging from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. *F. H. Bourne (Fixings) Ltd., Manor Royal, Crawley, Sussex.*

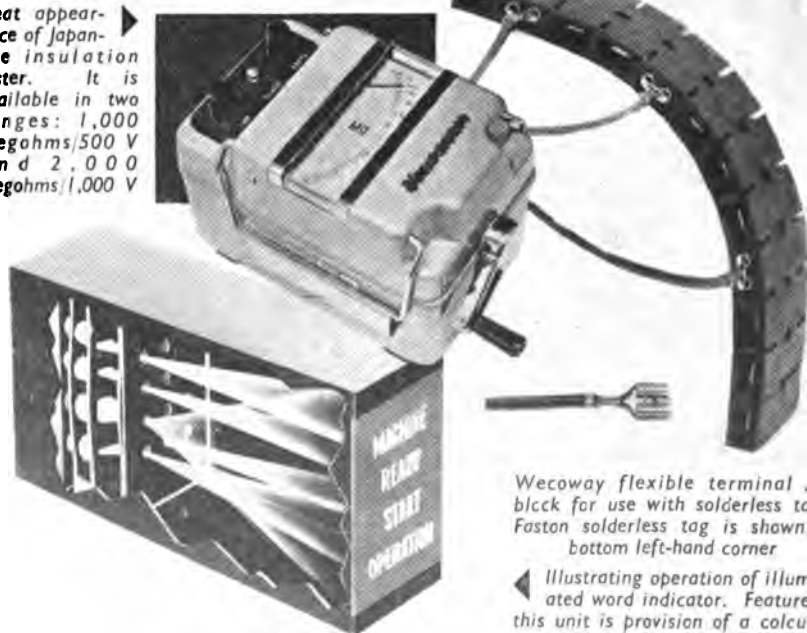
Illuminated word indicator

DETAILS have been released of an improved version of a unit which displays illuminated code words for giving visual indication of equipment operation. In addition to a selection of seven words such as "stop," "start" and "automatic," a new feature is provision for background illumination in any of five colours. It works on a back-projection principle employing 12 lamps and a system of lenses. The unit has dimensions $3\frac{9}{32}$ in. wide by $5\frac{1}{4}$ in. high and $11\frac{1}{4}$ in. long and is priced £16 10s. *Counting Instruments Ltd., 5 Elstree Way, Boreham Wood, Herts.*

Insulation tester from Japan

A JAPANESE-PRODUCED insulation tester now available in this country comes in two ranges: up to 1,000 megohms at 500 V and 2,000 megohms at 1,000 V. It incorporates a d.c. output, constant voltage hand-generator and has a dynamometer movement. A separate guard terminal is provided for volume resistance measurement. This is the "YEW Model L.5," which has dimen-

Neat appearance of Japanese insulation tester. It is available in two ranges: 1,000 megohms/500 V and 2,000 megohms/1,000 V



Wecoway flexible terminal block for use with solderless tags. Faston solderless tag is shown in bottom left-hand corner

Illustrating operation of illuminated word indicator. Feature of this unit is provision of a coloured background lighting to word display

sions 4.2 in. by 4.6 in. by 6.6 in., weighs 5 lb, and is said to be of robust construction. Each instrument is shock and vibration tested and is supplied with a certificate. *The Electrical Instrument Co. (Hillingdon) Ltd., Boswell Sq, Industrial Estate, Glasgow, S.W.2.*

Electro-chemical time indicator

INTERENDED for giving indication of operation time lapsed of electrical equipment, an unusual device consists of a cartridge unit containing a replaceable electro-chemical cell. This can be connected across the supply switch terminals of the equipment. Passage of steady current results in anode consumption proportional to time in hours which is marked by the length of the anode on a scale alongside. The cartridge unit is $2\frac{1}{4}$ in. long by 1 in. diameter and types available cater for a.c. or d.c. supplies from 6 V to 600 V. This "Selachron" range should find useful application in keeping maintenance and test-run records. *Industrial Instruments Ltd., 9 Paved Court, Richmond, Surrey.*

Solderless tag flexible terminal block

MANUFACTURED specifically for use with conductors terminated by "Faston" (made by Aircraft-Marine Products) solderless tags, the "Wecoway" flexible terminal block is available in 12 ways. The "Faston" tag has parallel twin inserts which are plugged into corresponding tongued sockets in the terminal block. This is said to make a firm, shakeproof electrical contact. If required, the block can be cut to a reduced number of ways. A similar type of terminal block in rigid thermosetting plastics will soon be on the market. *Metway Electrical Industries Ltd., Metway Wks, Canning St, Brighton 7.*



The Atcotrol 306 timer is designed specifically for controlling reversing machinery and process drives. It is one of a series of such devices being manufactured by Everett Edgcombe

Automatic timing

A SERIES of automatic timers, familiar to the American user, are now being marketed and manufactured in this country by Everett Edgcombe. The first three of these new timers are now in production. Each has a self-starting synchronous motor and is a miniature component measuring only $3\frac{1}{4}$ in. square with a single fixing hole.

The "Atcotrol 305" can control up to six load circuits and can be connected for over 100 circuit combinations. It is of the single-duty cycle type with automatic reset and has dial ranges from 15 sec to 60 hr. Two timers can be connected in tandem to give a continuously repeating duty cycle.

The "Atcotrol 304" is a percentage timer designed to control the ON and OFF timers of a single load circuit on a continuously repeating duty cycle. The dial is graduated 0-100% and the 100% basic timing cycle may be 15, 30 or 60 sec. This timer is particularly suitable for applications where electrical heating equipment is in operation.

The third timer, "Atcotrol 306," is essentially two timers in one and controls two independent adjustable load circuits on a continuously repeating duty cycle. A reversing automatic driving motor is incorporated, so arranged as to rotate the elapsed time indicator pointer first in one direction and then in the other between pre-set limit arms. Dial ranges are from 30 sec to 240 min. Everett Edgcombe Ltd., Colindale Wks, Colindeep La, Hendon, N.W.9.

Continental insulation

THE extensive range of insulating products, copper-clad laminates and sleeveings made by Messrs Dielektra A-G are now available in this country at prices and deliveries which are said to be competitive.

Among the range of insulation products is "Oleocel," a material claimed to be of particular interest to transformer designers. "Oleocel" cylinders, in contrast to the s.r.b.p. cylinders widely used in transformer construction, are formed from layers of paper which is shellac coated only to the extent of a pattern of discrete dots. This is said to give the important advantage that small channels, so formed in the tube wall, allow oil

to soak in during vacuum impregnation and at the same time provide a ready path for removal of volatile matter formed during the curing process. "Oleocel" is available in two grades, one formed from a slightly denser paper. Withstand voltages of 60 kV are claimed over a period of five minutes for an electrode spacing of $1\frac{1}{4}$ in. parallel to the lamina and $\frac{1}{4}$ in. perpendicular to the lamina when impregnated, and breakdown along the lamina under oil exceeds 75 kV/in. The material is said to undergo practically no dimensional change during impregnation.

Conventional s.r.b.p. is also available in a variety of forms; for example, flat sheets can be produced up to 30 ft by 42 in. Three other recent introductions are melamine paper and fabric and Perlon fabric—a material similar to nylon. Melamine paper has excellent anti-tracking properties, while the fabric, which also has high tensile strength, is readily punchable. The Perlon laminate is a rather more specialised material with high mechanical strength. Resistance to water absorption and fungus growth suits it particularly for tropical equipment. The Dielektra range also includes "feathered" interleaving paper in thicknesses from 1 mil to 10 mils, high quality micanite products and a range of silicone insulating materials. Engineering and Dielectric Products, 707 Victoria Hse, Southampton Row, W.C.1.

Simple rust removal

REMOVAL of rust from circulating systems without the need to dismantle them is claimed to be possible by using Pitan Rust Remover. The remover operates by a complexing action said not to attack unrusted metal. It is claimed to be suitable for use in turbine, boiler and engine circulatory systems. Small deposits are removed quickly, but larger rust formations may take some time to disappear. However, since Pitan may be left in the system indefinitely without damage this is claimed to be no disadvantage. Allweather Paints Ltd., 36 Gt. Queen St, W.C.2.

Quick inductance measurement

THE inductance and Q-factor of iron-cored inductors can be measured without undue bench preparation by using the Hay bridge manufactured by Furzehill Laboratories. The bridge measures inductance with or without a polarising d.c. flowing and is designed to operate over an unusually wide frequency range from 25 to 3,000 c/s. It has a

logarithmic meter, fed from a bridge output through a selective amplifier. This arrangement is claimed to eliminate waveform errors and to give a sharp null indication, ensuring precise and repeatable readings. Inductance is measured on 4 ranges covering 50 mH to 500 H. Calibration of the dial is independent of frequency and accuracy is claimed as $\pm 5\%$. Two resistive dials reading 25 and 1,000 ohm max. enable the Q-factor to be easily determined. Furzehill Laboratories Ltd., 57 Clarendon Rd, Watford, Herts.

Porous bearing material

CONTROLLED porosity gives a new nylon bearing material, "Nylasint," the ability to retain substantial quantities of oil for lubrication purposes. The material is intended for bushes, bearing cages and other applications where long, trouble-free life is required. "Nylasint" is formed by cold pressing and sintering crystalline nylon. Polypenco Ltd., 68 Tewin Rd, Welwyn Garden City, Herts.

Stable-arc welding electrode

ARC stability coupled with ease of slag control are the two most important features claimed for the "Opal $3\frac{1}{4}$ Ni" arc-welding electrodes. These two features enable d.c. and a.c. supplies to be used with an open circuit voltage down to 70 V. The electrodes are available in five sizes, from 4 to 12 gauge, suitable for currents ratings from 320 A to 90 A. The electrodes are intended for welding low carbon $3\frac{1}{4}\%$ nickel and similar steels. Cooper and Turner Ltd., Vulcan Wks, Vulcan Rd, Sheffield 9.

Lightweight spot-welding gun

FIRST of a number of new lightweight spot-welding guns to be put on the market, the "S.15 Autospot" weighs only 24 lb. It is intended for spot-welding mild, stainless and galvanised steel up to a thickness of 2 by 14 s.w.g. Tip pressures are adjustable up to 550 lb maximum and an electronic timer/contacter is fitted to ensure uniformity in welds produced. Welding arm change is effected easily by loosening a single Allen nut and the gun is supplied with four sets of arms in a special steel case. A class "H" silicon insulated transformer is incorporated, suitable for a 230/250 V 15 A supply. Price, complete with electronic timer, is £88 10s. Portable Welders Ltd., Castle Mills, Buckingham, Bucks.

S.15 Autospot lightweight spot-welding gun for fabrication of mild, stainless and galvanised steels up to 2 thickness 14 s.w.g. Weighing 24 lb it is fitted with an electronic timer/contacter to ensure consistent operation



News of the Week

BRITISH EXPORTERS CRITICISED

Lack of sales efforts and attention to markets

OVERSEAS criticism of British products is most serious in respect of design and styling, while exporting firms are criticised for lack of attention to particular markets and lack of sales efforts. That is the experience of Mr R. Maudling, President of the Board of Trade, expressed in a speech during last week's House of Commons debates. Such criticisms, he feels, are too frequent and widespread to be ignored.

Mr Maudling discussed trade at home and overseas in general terms, and on the export subject said his impression was that price and delivery of British firms were competitive all over the world. Quality of British goods was held in high regard; indeed, it was sometimes said to be too high. He warned of a tendency of British firms to think not only that they knew what was best for themselves, but they knew what was best for their customers also. This was a dangerous tendency.

In a brief reference to European trade relations, Mr Maudling said that attempts were still being made to find an acceptable basis for further negotiation between the Six, the Seven and the Commonwealth. Mr Maudling stressed the Government's intention of working in closer co-operation between themselves and private industry to promote overseas trade.

The Government intended to spend more on international fairs and be more active in inviting prominent overseas business men to visit the UK. There was to be a drive to tell British industry about export services the Board of Trade could offer.

Mr Maudling thought the general response to the export campaign that the Prime Minister had launched "had been extremely encouraging."

Another speaker in the debate was Mr Basil de Ferranti. He suggested that there was no longer an optimum size for a manufacturing concern. It was not technically valid to think in such terms; larger firms were able to produce more cheaply than smaller ones. If Britain were to achieve any sort of increase in the rate of productivity and step up

exports, it was necessary to have at least one company for each product as big, or preferably bigger, than any of its competitors overseas. However, there were industries like heavy engineering where there were not the same economies of scale that existed in the mass production business. The RTP Act could damage export trade in certain industries where there were no economies of scale, warned Mr de Ferranti.

BELFAST SEEKS LOAN

BELFAST Corporation are proposing to spend £397,500 on the city's electricity distribution system. At last week's monthly meeting, the City Council approved an application to the Ministry of Commerce for sanction to raise a loan for that sum for the purpose.

New Headquarters for S. Scotland Board

PLANS for new £350,000 area headquarters for the South of Scotland Electricity Board, at 130-132 George St, Edinburgh, have been approved by the Edinburgh Dean of Guild. It is proposed that the new building will house accountancy, secretarial, commercial, engineering and consumers' accounts departments at present located in three different offices in the city. A new service centre, to be located on the ground floor, will replace the present centre on the site, and there will be a basement car park. Erection of the new building is to be completed in 1963.

Appliance production eases off

LATEST firm to announce short-time work is Morphy-Richards (Astral) Ltd. Because of the general trade recession and the drop in sales of refrigerators their three Dundee factories are going on to a four-day week from 14 Nov. The Birmingham domestic appliance firm, Parkinson Cowan Appliances Ltd., have given notice to another 80 employees—100 workers were dismissed two months ago.

EXPLOSION AT BOLD "A"

A 30 MW turbo-alternator at Bold "A" power station, North West Merseyside and North Wales Region of the CEGB, exploded last Thursday, causing serious damage, but fortunately no serious injury to the station staff. Just after 9 o'clock in the morning the l.p. rotor on No. 2 machine disintegrated, and the set was completely wrecked, pieces of metal flying in all directions and causing severe damage to No. 1 machine. The

accompanying fire was quickly extinguished. No. 4 set was non-operational at the time, undergoing its annual maintenance check. No. 3 machine, which has a water-cooled rotor, was only slightly damaged and is expected to be in service within a few days. Supplies to a large section of south west Lancashire were cut off, but were restored after about ten minutes from an alternative source at the Carlton St grid substation.



Rise for plumber jointers

AN increase in pay of 5½d an hour for plumber jointers, both in London and the rest of the country, operative from 20 Nov., has been agreed by the Joint Industrial Council for the Electrical Cable Making Industry. The new hourly rates will thus be 5s 10½d in London, and 5s 7d elsewhere. For plumber jointers' mates the new rates will be 5s and 4s 9d, respectively. There are also consequential increases for learners and others under the agreement.

WHICH? on Light Bulbs

LIFE and value in electric light bulbs are discussed in the November number of *Which?*, the publication of Consumers' Association Ltd. Nine brands were tested, it being claimed that these represent over 80% of sales in the U.K. But the meaning of all results is reduced by a disclaimer that "what we tested were 240 volt, 60 watt, pearl bulbs only. Assessment of brands is for this voltage, this wattage and for pearl bulbs only."

All bulbs tested were 240 volt, 60 watt pearl (except for one silica-coated type). Tests were made for life, light output and energy consumption. Life tests were extended until 50% of bulbs in a batch had failed; 50 of each brand and type were tested. Lamps were switched off for 15 minutes every eight hours. In these conditions (more stringent than the BS) all except one type reached BS standards. Life to the 50% failure rate ranged from 1,055 hr to 1,630 hr for single coil lamps and from 885 hr to 1,675 hr for coiled coil lamps, excluding "double life" lamps.

Efficiencies for single coil lamps range from 8.2 to 9.7 lumens/watt at 1,250 hr life. The lowest efficiency related to the longest lamp life. For coiled-coil lamps the efficiency measurements were 10.6 to 10.9 lumens/watt.

On value for money, *Which?* points out that various criteria may apply. For example, long life may be important

because of difficulty of replacement; or minimum electricity consumption for given output might apply. For economy of use, *Which?* recommends purchase of coiled-coil bulbs, of which Crompton is called "best buy." For long life the "best buy" accolade is given to the Ascot. However, the table on which the economy recommendation is based for some unexplained reason excludes some makes of coiled-coil lamps which, in fact, work as cheap or cheaper on the stated basis, average cost of bulb/1,000 hr plus cost of running to give 600 lumens for 1,000 hr.

ELECTRICAL ACCIDENTS

FIVE types of electrical accidents are noticed in the October number of the Ministry of Labour quarterly *Accidents*. One of these stresses an important warning about work on low-voltage accumulators. Although these seem danger-free, if the terminals are shorted out with a conductor—in the accident described, a spanner—and there is a ring on the workman's finger, serious burns can be received. Another burn case arose when an electrician was checking a circuit with make-shift test prods. This incident emphasises the value of test prods with fused, insulated handles.

STUDENTS ABROAD

1,008 STUDENTS of electrical engineering gained a vacation experience abroad during 1960 with the help of the International Association for Exchange of Students for Technical Experience. This is stated in the Association's annual report for that year. 103 of the students were from the UK. Electrical engineering firms in Britain received 178 foreign students for vacation training under the scheme, in which altogether 6,430 students participated, covering a wide range of technologies. The report records that 24 countries are participating in the scheme, ranged as distant as Iceland, South Africa and the USA.

OFFICIAL PUBLICATIONS

Electricity (Amendment) Bill. HMSO. 6d (see page 736).

Patents and Designs (Renewals, Extensions and Fees) Bill. (H.L.). HMSO. 4d (see page 734).

Weights and Measures Bill. (H.L.). HMSO. 5s 6d (see page 708).

Infra-Red Heat for Chick Rearing. Ministry of Agriculture Advisory Leaflet 426. HMSO. 3d.

Thirteenth Survey of Electric Power Equipment. OEEC Report. 10s (see page 728).

NCB Specification 209: 200 A medium-voltage flameproof air-break circuit-breaker. 1s.

Training of Graduates. The Professional Electrical Engineer. Report of Joint Committee. IEE. 2s (see page 737).

Patents and Designs Bill

INTRODUCED last week, the Patents and Designs (Renewals Extensions and Fees) Bill proposes to extend to six months the period of grace for the payment of renewal fees for patents and also for the extension of the period of copyright in registered design. The Bill will also provide a similar period of grace for the making of applications for such extension, to validate certain extensions of the copyright period. In order to allow certain fees chargeable in respect of patents to be increased, the Bill also repeals the proviso to Section 99 of the Patents Act, 1949, and the First Schedule to that Act, which provides for a statutory ceiling on those fees.



Fitting strip lighting to the interior of the Lord Mayor of London's coach in preparation for the procession on 12 Nov. Three 18 in. tubes being installed will improve the view for the public

REACTORS IN CITIES

LOW-POWERED nuclear reactors, such as those used for experimental purposes, may be built and operated on urban sites, the Minister of Power has decided. In announcing this last week he indicated that he had approved the grant of a licence to install a 10 kW (thermal) nuclear reactor at Queen Mary College, University of London.

In reaching the decision the Minister has had advice from the Nuclear Safety

Advisory Committee. They feel that a number of safe designs for small experimental reactors are available. However, the approval is not a blanket one. Factors affecting safety will have to be considered for each individual project, and careful attention will be given to siting. The implication of the Committee's advice to the Minister is that a proposal to erect a reactor should not be ruled out merely because the site is in an urban area. Reactors of the type concerned are normally used in a substantial structure. Detailed operating conditions will apply.

FURNACE CO-OPERATION

THE Hawker-Siddeley Nuclear Power Co. Ltd. and Spemby Ltd. (a member of the Harper Group) have agreed to co-operate in the design, manufacture and selling of specialised high-temperature furnaces. The agreement provides for the joint exploitation of large high-temperature furnaces of a type designed and now being commissioned by Spemby at Hawker-Siddeley Nuclear Power Co. Ltd. works at Langley. The furnaces, stated to be four times larger than anything of their type in the world, are for use in research in the nuclear and high temperature field.

Retail Sales High

RETAIL sales were well maintained in September at a level about 4% higher than a year ago. Sales of appliances and furniture showed a further slight decline but this was offset by buoyant trading in clothing and footwear, latest figures from the Board of Trade show. Instalment credit sales of household goods showed a seasonal increase of about 10%, but were still 30% below September last year. The overall hire purchase debt continued the downward trend evident in August, falling £8 million to £962 million.

Eire's increased expenditure

statutory limit on capital expenditure the Eire Electricity Supply Board objects other than rural electrification: being raised from £100 million to 20 million under the Electricity (Amendment) Bill, 1959, which given a second reading in the Dail week. Under the Bill the limit on expenditure on rural electrification raised from £30m to £32m.

organ's New Venture

W company, Morgan-Mintex Ltd., then formed jointly by the Morgan & Co. Ltd. and British Belting and Co. Of the £140,000 authorised, Morgan Crucible are providing 60 and British Belting the remainder.

new concern is to manufacture and friction materials, which are to be marketed under the name "Sinter" by the Mintex Division of British & Co. The board of Morgan-Mintex consist of five directors, three of which are from Morgan Crucible and two from British Belting.

bing unofficial strikes

tougher line by the unions against double-making shop stewards common in the electricity supply industry is beginning to take shape. While national executive of the Amalgamated Engineering Union has asked Wake, secretary of that unofficial committee, why he defied a union instruction to take part in the recent conference at Birmingham, all the five concerned are planning joint action to eradicate the trouble.

latter scheme, apparently, is for it declaration that the unofficial stewards' movement is an impediment to the official negotiating machinery should be made redundant by a change of the communications between the unions and members. As part of this it is suggested that district officials should be allowed to attend the meetings of the unions' committees, but this would require an amendment to the NJIC proposal: agreement. At present, the union does not provide for the presence of full-time union officials at meetings. The plan is expected to be finalised very shortly.

L.C.C. Tightens Fire Precautions in Stores

few of the recent Liverpool store disasters, the London County Council made a special survey of fire precautions in 74 large London stores. Among other stipulations, the Council already requires that all false ceilings shall be of non-combustible material. But the Council has no power to require the provision of fire alarm systems, except as a condition of consent to the erection of the largest stores. But henceforth the Council's

officers propose to review the circumstances of each building inspected and, where necessary, offer advice to the proprietors on alarm systems and other fire precautionary measures.

It is also proposed that planning consents for the erection or reconstruction of stores shall in future include, where appropriate, a condition requiring the provision of suitable fire alarm arrangements.

COOLKEERAGH STATION OPENED



An aerial view of Coolkeeragh power station on the shores of Lough Foyle, with the tonnage acetylene plant of Carbide Industries Ltd. in the foreground

THE first oil-fired power station in Northern Ireland, Coolkeeragh near Londonderry, was officially opened last week by the Princess Royal. Built for the Electricity Board for Northern Ireland, the station has been in operation since last December when the first 30 MW set was commissioned. A second similar machine is now operating and construction of a 60 MW set is well advanced, to be in service by the winter of 1961. The Ministry of Commerce recently approved a scheme for the addition of a further 60 MW set, and the station can accommodate three more sets of that size.

At the official ceremony, Mr James Walker, chairman of the Board, stated that the units purchased and chartered

for use in the Board's area for the nine months to 30 Sept. last showed an increase of over 21%, of which it was estimated 15% was by way of normal growth, the other 6% being attributed to the additional load from the two large industrial undertakings (Du Pont and Carbide Industries) at the Maydown site near Londonderry.

Over £20 million has already been invested at Maydown in these industries. The power station supplies electricity, steam and demineralised water to the adjoining factories.

Consulting engineers for Coolkeeragh power station are Kennedy and Donkin, the associated civil engineering consultants being Sir Alexander Gibb and Partners.

Glasgow's 25 kV Suburban Service

PHASE ONE of British Railways Scottish region's Glasgow suburban service, serving stations north of the Clyde, was inaugurated on 5 November by Sir Brian Robertson, chairman of BTC. Among those present at the ceremony were: The Lord Provost of Glasgow, Mrs Jean Roberts and Sir Robert Inglis, who was responsible

for the report strongly recommending the electrification scheme. Sir Brian said that the decision to electrify had only been taken after an exhaustive review of the city's transport requirements. The old steam lines had lost money heavily and popularity of the new system would to some extent determine when the second phase, electrification of the lines in the heavily populated area south of the Clyde, would follow.

Cost of the scheme, which covers 52 route miles, was £16 million. The electrification programme commenced in April, 1956, on the basis of the standard-

ised 25 kV a.c. system, with reduction to 6.25 kV in certain tunnels.

Glasgow Corporation had co-operated by integrating their existing public transport system to key in with the newly electrified lines. Power for the system was derived from the grid and controlled from a single control room at Cathcart. Not only will service frequency be considerably improved, but journey times will be reduced by 20% to 30%.

The coaches are similar to those used on the London suburban electrification schemes. Extensive relaying of track and raising of bridges was necessary and a complete system of colour-light signalling to replace the old semaphore arms had been installed.

Down the Slipway

THE Post Office will soon have another cable ship in service—the 4,000 ton *Alert* launched on the Clyde on Monday. Built by Fairfield Shipbuilding and Engineering Co., *Alert* is equipped with diesel-electric propulsion machinery and auxiliary generators supplied by AEI Heavy Plant Division.

ONE PLANT, ONE ORDER—
... Lord Coleraine at B.E.A.M.A. Conference

BRITAIN might lose export orders worth millions of pounds if the purchaser of a power station, or other huge project, continued to have to chase around among half a dozen firms for various components, Lord Coleraine said last week. In Germany and Japan the customer could take his order to a single person. An extension of the consortium principle, already evident in the nuclear power field, might be the means of closing the gap, he told the fifth BEAMA publicity conference.

Undoubtedly, the first duty of publicists in the electrical industry was to increase the prosperity of their own firms, Lord Coleraine said, but with the increasing dominance of electricity in daily life, they had another duty—to help minimise mistakes by telling the Government and the people about the problems of the industry. The detrimental effects of erratic purchase tax and hire-purchase legislation on the cost of producing domestic appliances was one thing of which Lord Coleraine felt both Government and public opinion should be made more aware.

Professor W. Taplin, of the London School of Economics, told the conference that he had discovered a distaste for advertising among some advertising managers themselves, when he questioned the executives of 40 firms recently. That was hardly the way to get the best results. He thought the anti-advertising fashion among the public would wane. Mr W. D. McClelland, associate manager of sales promotion for Odhams Press, said market research was an essential tool for the advertising manager, but it should not replace creative imagination. Recent surveys had shown that 70% of families comprising the working class group continued to be the most rapidly expanding market for appliances, particularly for washing machines.

The conference was divided on the question of training tomorrow's industrial publicity managers. Those with technical

qualifications considered that a technical background was of primary importance; those without were convinced that it was unnecessary. Members of the panel leading the discussion had technical qualifications, with the exception of the trainee representative. Earlier, opening the conference with a description of the coming "Techtopia," Professor W. H. G. Armytage, of Sheffield University, had stressed the need for technological expertise as well as hinting that it may be necessary to come to terms with science.

I.E.E. Liverpool dinner

COLLABORATION between professional engineering institutions is favoured by Sir Hamish MacLaren, president of the IEE; but not amalgamation. Sir Hamish made this clear in a speech at the annual dinner of the Merseyside and North Wales Centre of the IEE on Monday. He said action to publicise what an engineer did was the sort of thing that might be tackled co-operatively. Principal guest at the dinner was Admiral Sir Michael Denny, chairman of Camell Laird, who spoke of the changeover in emphasis from mechanical to electrical engineering in the Royal Navy. Today, the Royal Navy could not exist without miles of cable and numerous switchboards. The changeover had been brought about by the electrical engineer. The toast of "The Guests" was proposed by Mr T. A. P. Colledge.

INVESTMENT IN ELECTRICITY SUPPLY

INVESTMENT figures for electricity supply in the British Isles, reported in outline in last week's ELECTRICAL TIMES, are shown in more detail in the accompanying table, which is based on a Government White Paper published last week. Notes on these investment figures published in the White Paper add little to information on forward plans already available in annual reports of the boards concerned.

Outstanding in the figures in England and Wales is the growing proportion of generation expenditure attributable to nuclear power stations. In 1960 (i.e., the year ending 31 March, 1961) almost one-third (£53 million) of the generation expenditure comes under this heading and, in 1961, more than one-third (£58 million). In addition, the CEBG is having to meet the cost of initial charges of nuclear fuel for reactors, estimated at £6.5 million in 1960 and £13.6 million

in 1961. Initial charges of fuel and reserve stocks kept at stations are treated as capital plant, while nuclear fuel replacing that "burnt up" is charged to revenue account. Nuclear stations expenditure by S. of S. EB is estimated at £9.7 million in 1960 and £5.5 million in 1961. (Generation figures in table include initial fuel.)

The White Paper is the first of what is promised to be an annual series summarising all public investment programmes. Electricity at £337 million in 1960 is the largest single item in the list out of a total of £1,710 million. In 1961 it accounts for £358 million out of a total of £1,730 million.

The White Paper warns that forward estimates such as these are subject to many uncertainties. Changes in delivery dates and revised forecasts of requirements can produce sizeable changes. This has happened particularly with electricity. Moreover, the White Paper says that once work has begun on a project it is usually uneconomic to attempt either to accelerate or retard it at short notice as an instrument of general economic policy.

Amongst major changes on investment level noted in the White Paper is that of British Transport Commission, for whom the railways expenditure of £160 million in 1960 is to be slashed to £125 million for 1961. This reflects postponement of certain expenditure, including presumably main line electrification, pending outcome of the review.

C.E.G.B. to make Isotopes

POWER for the CEBG to make and sell radio-active isotopes in their nuclear power stations is proposed in the Electricity (Amendment) Bill introduced in the House of Commons last week. The Bill is made necessary because the Electricity Act, 1957, forbids the Board to manufacture anything except what they or an area board may require for research or development, repair or maintenance.

The Bill is a short measure of only two clauses. It is reckoned that it will not involve more than £250,000 in capital expenditure by the CEBG to facilitate production of radio isotopes.



Packing 33 100 h.p. drip-proof motors before dispatch from Brook Motors' Huddersfield works to Venezuela. With Class "B" insulation, and rodent proof, they have been supplied to Phillips Petroleum Co.

Electricity Supply Investment Plans in £ million

	1960*				1961*			
	England and Wales	South Scotland	North Scotland	Total	England and Wales	South Scotland	North Scotland	Total
Generation ...	170.0	14.2	7.8	192.0	173.6	11.5	11.7	196.8
Main transmission ...	33.0	3.0	1.5	37.5	41.0	3.5	1.7	46.2
Distribution ...	95.3	8.8	3.1	107.2	103.4	9.0	2.6	115.0
Total ...	298.3	26.0	12.4	336.7	318.0	24.0	16.0	358.0

* Year ended March, 1961, and March, 1962, for England and Wales.

I.E.E. Restate Training Requirements

RECOMMENDATIONS for the training of graduate engineers as part of their preparation for corporate membership of the IEE are set out in a revision of *The Training of Graduates*, a report of the Committee on Practical Training in the Electrical Engineering Industry. Most of the publication repeats its predecessor of 1957, with reaffirmation of the belief in the three-point plan of basic workshop, general mechanical and electrical training, and directed objective training. It is an indication of what the IEE looks for when prospective professional engineers take the newly approved training route of training on the job—training in a staff appointment—as it is

able in the report is a further shift towards earlier ideas of apprenticeships, with emphasis on the importance of providing a course of training with the same work and challenge as the academic which the graduate has completed. It is a warning against engineering firms taking staff appointments

which provide little opportunity for training.

The publication is in effect an indication of some recommended ways of fulfilling the requirements of the Training Regulations of the IEE, issued last year, so far as graduate engineers are concerned. It is available from the Secretary, IEE, Savoy Pl, London W.C., price 2s 6d post paid.

A.E.I. Work on Telescope

AEI is making all the electrical equipment for the world's second largest radio-telescope which will go into operation next year at Parkes, 200 miles west of Sydney. Planned by Australia's Commonwealth Scientific and Industrial Research Organisation, the new telescope will supplement the work of its big brother at Jodrell Bank. AEI's cable factory at Lydbrook is making special "lubricated" multicore cables which are housed in a "cable twister" to lessen the mechanical stresses imposed by the telescope's horizontal rotation.

PHYSICS EXHIBITION

RECENTLY amalgamated into a single body, the Institute of Physics and the Physical Society will hold the annual exhibition of scientific instruments and apparatus at Westminster from 16-20 Jan. Lectures on hydrodynamic research, the physics of the oceans, and problems of supersonic speed are included in the programme. Previous exhibitions have been under the auspices of the Physical Society, before the amalgamation.

MORE POWER FOR HULL



Mr D. Bellamy, YEB chairman, with Mr C. H. Hudson, chairman, Haltempryce UDC, at the ceremony

SUPPLIES for Hull and district have been augmented by a 45 MW substation opened recently at Hessle. Known as Hull West 132/22 kV Grid Supply Point, the new substation is fed from the grid through Yorkshire Division's Creykebeck supply point. Transmission is by means of a double-circuit 132 kV overhead line 7½ miles long. The layout includes two 30 MVA 132/22 kV grid transformers. These are of the outdoor oil-cooled type fitted with oil-circulating pumps and cooling fans automatically started at a pre-determined temperature.

IA SEEKS MORE TRADE CHANCE FOR EXPORTS

IA is willing to double her trade Britain by entering long-term contracts to supply the UK with iron ore, other minerals in exchange for engineering goods. Mr Patolichev, Soviet Minister of Foreign Trade, told a delegation from the British Institute of Engineers this in Moscow recently. An appointment which augurs well for the Trade Fair in Moscow next May reaching the right contacts is one of the major difficulties of selling to the USSR. The delegation, which included B. Scott, a director of Crompton, believes that the British representative should get into direct touch with the directors of the Russian factories to use their products. Permanent representatives of foreign firms are still few in Russia, but the delegation from Mr Patolichev the assurance visits to plants by British representatives would not be precluded. The delegation advocates the setting up of a trade mission in Moscow by British business organisations to arrange contacts.

Large Contracts Awarded

... Petbow Ltd.

Petbow Ltd. have received a contract from the Air Ministry for eight 200 kVA standby mains-failure generating sets for their "Ace High" project. Four stations are each to have two sets which consist of Rolls-Royce eight-cylinder turbo-charged diesel engines coupled to Macfarlane transistorised alternators. The complete sets will be resiliently mounted on

"Cushyfoot" mountings bolted onto a concrete foundation.

Remote radiators with electrically controlled fan and louvres will be installed and the generating sets will carry a comprehensive range of alarm systems. Each set is capable of starting and accepting a full load in less than 15 sec, in an ambient temperature of -5°C, should the mains fail.

... G.E.C.

G.E.C. is supplying £50,000 worth of equipment to convert from steam to electric drive a winder in Withok gold mine (an Anglo-American Corporation gold mine at Withok on the Rand). Twin 6.6 kV 1,150 h.p. ten-pole a.c. motors will be used to drive the 12 ft by 5 ft double-drum winder.

Wharton Crane & Hoist Co.

Wharton Crane & Hoist Co. will next year install £50,000 worth of overhead cranes in James Booth Aluminium Ltd.'s works at Birmingham. The contract includes a 110 ton, four-motor cage-controlled electric travelling crane, with a change speed gear giving treble hoisting speed for loads up to 37 tons.



Sir Hamish D. MacLaren, IEE president, was guest of honour at the annual dinner of the AEI (Rugby) Overseas Association, at Coventry, when Lord Chandos pointed out that AEI was the first to form a group of companies under one name

Sir Hamish D. MacLaren, IEE president, was guest of honour at the annual dinner of the AEI (Rugby) Overseas Association, at Coventry, when Lord Chandos pointed out that AEI was the first to form a group of companies under one name

BRITISH TRADE FAIRS FOR MEXICO

TO tap the £400 million Mexican market the FBI are to hold two consecutive industrial trade fairs in Mexico City, from September to November, 1961. Announcing this at a recent Press conference, Sir Norman Kipping, director general of FBI, said that accent of the exhibitions would be almost entirely on capital and producer goods; for industry and construction in the case of the first exhibition, agriculture, food processing and public services equipment being features of the second. High on the list of exhibits will be heavy electrical plant, dairy and grain-drying equipment, factory machinery and associated control installations. Also to be shown are plant for refrigeration, dehydration and air-conditioning, and telecommunications apparatus.

In 1959, the US had a 73% share of the Mexican market compared with the UK's 4% and W. Germany's 7%. The Mexican Government were, however, anxious that there should be further competition from European manufacturers. There were, at present, heavy restrictions on consumer goods imports into Mexico. This was because the country's economy was adjusted to maintain full employment for a population growing at the rate of 4.5% a year, by encouragement of local industry.

WALTHAMSTOW SHOW

THE task of enlightening business men about electricity was taken up by the North Eastern District of LEB recently with a conference and exhibition. The 26 industrialists who attended heard Mr A. E. Marchant, manager of the district, stress the contribution of electricity to productivity, and representatives of AEI and the British Lighting Council discuss lighting, heating and motors and control gear.

Sayings OF THE WEEK

"I believe that we are largely mis-using our graduates during their training period in industry. Their keen minds should be employed in attempting to find solutions to the endless problems in the fields of design, development, controls, automation, metrology, standardisation and so on." . . . DR W. ABBOTT, on Overseas Graduate Training, at the IEE.

"This is a success story and may rid some people of their prejudices against nationalised railways. For people who do not think, it is better at least to rearrange their prejudices once in a while." . . . LORD PROVOST OF GLASGOW, MRS J. ROBERTS, at inauguration of Glasgow suburban railway service.

"Every hydro board in the world apparently has been subjected to continual attack." . . . MR THOMAS JOHNSTON, former chairman, N of Scotland HE Board, writing in the Glasgow Herald.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, November 8

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	225	+4½	ZINC, virgin, min. 98% purity (cash) ...	88½	+½
" (3 months) ...	225	+2½	" (3 months) ...	87	+½
LEAD, refined pig. 99.97% purity (cash) ...	69½	+½	RUBBER, per lb No. 1, RSS, spot ...	26½d	-½d
" (3 months) ...	69½	-½	c.i.f. basis, ports, Jan. ...	26½d	-
TIN, refined, min. 99.75% purity (settlement) ...	800	+3½	ARMOURING: Galv. Steel Wire (0.104 in.) ...	66½	-
" (3 months) ...	798	+2	Mild Steel Tape (0.04 x 1½ in.) ...	53½	-
ALUMINIUM, ingots 99.99.5% (3 months) ...	186	-	NICKEL (home) ...	600	-
wire bars (4 x 4 x 54") ...	193½	-	MERCURY (76 lb flask) ...	70½	-
BRASS Strip 63/37 ...	201	+3½	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	-
SILVER (Troy oz) ...	79½d	-	Lead. (New York) ...	12c	-

* Tape Price, now an average, includes varnishing

PUBLIC WORKS EXHIBITION

OPENING at Olympia on 14 Nov. is the seventeenth Public Works Exhibition. The opening ceremony will be performed by the Rt Hon Henry Brooke, Minister for Housing and Local Government. The exhibition continues until 19 Nov. and is held concurrently with a Congress at which will be presented a series of papers that will include two dealing with water and space heating in flats, and public lighting.

Exhibits range from heavy earth-moving equipment to illuminated road signs. One company is showing a rotary compressor designed for powering from a Land-Rover and there are several new pumps, including versions designed for

handling solid materials. Diesel engines are also strongly represented, one well-known manufacturer of petrol engines showing a 4 h.p. four-stroke engine which signals their entry into the diesel field. The trend in road signs is illustrated by the large fluorescent-lit type developed for motorways, and electric road danger lamps are also on view, suitable for use with either mains supply or an engine alternator unit. Two electric displays of interest are welding generators designed for 650 A and 400 A rating with continuous current adjustment and a battery charging a.c. generator with rectified output and transistorised charge regulator.

SERVICE TO INDUSTRY

EVERY aspect of the service and advice available to industrial consumers will be featured in an exhibition to be staged by Manweb at the Board's Industrial Development Centre, Liverpool, from 15 to 25 Nov. In addition to examples of prototypes constructed at the Board's test and development laboratory to deal with specific industrial problems, there will be working exhibits of various apparatus. Two lectures, on: "Factors aiding efficiency" and "Protection and control by MCB's," on the evenings of 17 and 24 Nov., will complete the programme.

Computing system memories

WITH the object of focusing attention on ideas for novel computer memories capable of storing very large amounts of information, the US Navy is organising a symposium to be held in Washington, DC, USA, on 23 to 25 May, 1961. It is planned to present a collection of papers concerning suggested new techniques and attendance is open to all interested technical personnel. Further information is available from Miss Josephine Leno, Code 430a, Office of Naval Research, Washington 25, DC.

News in Brief

The CEBG were hosts last week to a three-man delegation from the Finnish State Power Board.

Annual dinner of the Electrical Wholesalers' Federation will be held at the Dorchester Hotel on 23 March next. The a.g.m. will be held at the Park La Hotel earlier that day.

Derbyshire County Council Highways Committee have approved a scheme for electric-warming cables beneath the road surface in Alfreton Hill, part of the main Derby-Sheffield road.

The J and P Foremen's Association held their fourteenth annual dinner recently.

"The Census of Production (1961) (Returns and Exempted Persons) Order, 1960, SI No. 1978, just made, prescribes the matters about which returns may be required by the Board of Trade.

350 members of the Social and Athletic Club from the AEI Willesden Wks attended the annual dance recently.

There was a record attendance at the annual dinner of the ETCTA (Midlands Branch) at Birmingham on 28 Oct.

On the Liverpool St-Sheffield-Southend line, Eastern Region, BR, the existing 1,500 V d.c. system was converted to the new BR standard high-voltage a.c. 50 cycles system last weekend.

Company Activities

Throgmorton Street, too, seems to be a bit under the weather. Not a £11 million rise in Britain's gold convertible currency reserves in the month of October managed to be slackening of interest for the shares last week. A little sur- this, for the October figures gave ninth successive monthly increase Reserves and was struck after £30 million to the International Fund—the last instalment on £1 million borrowed in 1956—and on to the old European Payments But on the day these figures were ed, down dropped the *Financial* dex of industrial Ordinary shares ts to 316.1—the largest fall for day since Bank Rate was raised It is true that gold and currency s of October's size cloak a great the "hot money" that has come ndon in search of our extremely ertest rates, but at the same time d be remembered that October od when the seasonal strain on is near its peak. disturbing for investors was the given by the Governor of the England in which he declared: ry clear that today's situation at es not justify any change of the credit policy." st this background, electrical vere seen to be wilting and not e proposed £21 million increase million in Government spending ricity for the 1961-62 financial lped to arrest this downward us AEI, after its recent show of , came back over the week from o 45s, while GEC shed 1s 3d to English Electric, too, eased

be Ltd.
ugh the group profit, before tax, year ended 31 May last is down at £274,902 (£295,824), the divi- maintained at 54%, with a final Net profit is £159,542 (£172,439).
Electric Resistance Co. Ltd.
increased profits for the year July last, dividend is also raised ; (against 15% last time) with of 12½% on capital as increased e-for-five rights issue. The profit £72,179 (£57,473) and, after tax, net profit is £38,779 (£29,273). o proposed to make a one-for- ip issue; and it is the board's i, in the absence of unforeseen ances, to maintain a 17½% divi- the large capital for the current

e Electrical Industries
ugh profit for the year ended last is slightly down at £206,063 2) after taxation, etc., the dividend fect, increased, with a final of

back 2s 3d to 33s 3d. Parsons softened 3d to 46s 3d and "twin" Reyrolle sagged 1s 9d to 34s 6d. There was little more activity in the shares of E. K. Cole and Pye on the merger terms after the initial adjustments in the 5s ordinary of E. K. Cole, which were marked down 5s 3d to 22s 3d, but then recovered a mere 1½d to 22s 4½d.
Other dull spots included Hoover 5s "A" shares, 2s 1½d off at 41s, Thorn 5s Ordinary, 2s 7½d lower at 45s 7½d, and Plessey 1s 6d easier at 49s.
One of the very few rises of interest to the electrical market was recorded by J. and F. Stone Lighting and Radio, but even here, despite the chairman's optimism, the gain was limited to 9d, leaving the shares at 26s 4½d. Harper Engineering and Electronics, too, reported last week, and it was somewhat surprising to see their 1s Ordinary shares dip 7½d to 10s 3d in view of the tale chairman Mr Norman Weaver had to tell shareholders. The group net profit after tax is up from £115,801 last time to £645,360 for the year ended 30 June, 1960, and the proposed final dividend of 40% makes the year's total up to 80% against 30% for 1958-59. Both orders and sales are still going up weekly and in the first quarter of the current year profits were running about 20% above the corresponding 1959-60 period.
Mr Weaver also hinted that there are free scrip and "rights" issues coming. This sort of performance, if continued, will take some of the speculative flavour from the shares and with a current yield of 7.8% provides share hunters not only with high income but with the lively possibility of further capital appreciation. —From our City Correspondent.

8½% making a total of 12½% of the £1,200,000 capital, as against 20% last time on £600,000 capital.
Falk, Stadelmann and Co. Ltd.
With a reduction in the group profit for the year to 31 March last, dividend is cut by 2½% to 7½% with a final of 2½%. Profit is down to £217,271 from the previous year's total of £371,236. After taxation, etc., the net profit is £96,840 (£189,574). The chairman, Mr H. Falk, points out that difficulties occurred mainly in the field of electric cable and paraffin oil burning heating appliances, and there was also a sudden and complete cessation of trading in certain important overseas markets for the greater part of the year.
Harper Engineering and Electronics
A final dividend of 40% makes the total 80% for the year ended 30 June last, on the enlarged capital. The group profits, including approximately £55,000 attributable to accounting periods in excess of 12 months, amount to

£848,304 (£166,752) after charging depreciation at £168,916 (£46,546).

Simms Motor and Electronics Corp.
In addition to a maintained interim dividend of 5% on increased capital, a proposed one-for-ten scrip issue is proposed.

S. Smith and Sons (England) Ltd.
A final dividend of 15½% increases the total distribution by 2½% to 20% for the year ended 30 July last. Group profit for the period rose to £4,190,708 (£3,603,977).

J. and F. Stone Lighting and Radio
The improved figures for the past year were largely due to lifting of credit restrictions, but, since these were re-imposed this year, credit turnover has slowed down considerably, Mr D. G. Nairn, chairman, tells shareholders. The group has 97 branches—11 shops were acquired during the year—and it is proposed to open more new branches. He

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	1,198,758	449,667	130	50*	16/1	10/4
1957	1,237,780	447,601	65	30	25/3	15/3
1958	860,678	309,188	45	30	27/4	16/6
1959	617,120	280,775	38	30	37/-	26/-
1960	915,802	386,269	53	35	38/9	24/9

* Plus 100% capital bonus.

also states that the company would not be adverse to acquiring a group of stores should the opportunity present itself, although there is no intention of paying more than the true economic worth. On the other hand it is proposed to spend a substantial sum on expansion and modernisation of a number of existing branches.

Strand Electric Holdings
It is already apparent that turnover for the current year will establish another new record, Mr J. D. H. Sheridan reports. The Australian subsidiary provided a substantial contribution to profits in the past year, and it is expected that Canadian activities will do likewise in the current year, although they suffered a loss there last year.

Tube Investments
With trading profits of the subsidiaries for the year ended 31 July last increasing to £24,112,288 (from £16,782,643 in the previous year), dividend is also raised. A final of 9½% on the increased capital makes the total 20%, as against 18½% last time. After charging depreciation, taxation, etc., the net profit of the group is £8,100,735 (£6,458,460).

Intended Dividends
Broxlea Holdings. Interim 17½% (same).
East African Power and Lighting. Interim 4% (3%), but increase does not indicate a higher total.
London Electrical and General Trust. Interim 6% (same).
Ward and Goldstone. Interim 5%, against the equivalent of 4% last time.
G. and J. Weir Holdings. Interim 6% (same).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

- 10 Nov.—Derby B.C.** Supply of 49 200 W sodium discharge units on 35 ft steel columns for A5111 Raynsway Trunk Rd lighting.—Advertised 27 Oct. issue.
- 10 Nov.—Suffolk and Ipswich Fire Authority.** Electrical work at Colchester Rd Fire Station.—Advertised 27 Oct. issue.
- 10 Nov.—Sunderland B.C.** Electrical installation in sports pavilion, Marley Pots.—See 3 Nov. issue.
- 11 Nov.—Armada B.C. (b)** Electrical work in erection of 155 houses in 49 blocks on Bevan site, East Main St. Applications to Town Clerk, H. H. K. Clarkson, 4 South St, by above date.
- 11 Nov.—Horsham U.D.C.** Supply and erection of 26 Stanton Group "B" concrete columns and G.E.C. post-top lanterns for Hawkesbourne Rd and Redkiln Way lighting.—See 3 Nov. issue.
- 14 Nov.—Dunbarton C.C. (8)** Electrical installation in proposed police station, house and garage at Arrochar. Applications to County Architect, J. Miller, Ferry Rd, Old Kilpatrick, by above date.
- 14 Nov.—Essex C.C.** Supply and erection of 11 35 ft tubular steel columns with 200 W linear sodium lamps at Stump Cross, near Gt. Chesterford. County Surveyor, Highways Dept, Old Court, Chelmsford.
- 15 Nov.—Beckenham B.C.** Re-wiring of 112 houses on Elmers End Hsg estate. Borough Engineer, Town Hall.
- 15 Nov.—Cumbernauld D.C.** Power and lighting installations in three pumphouses, underground cabling to ten motors and exterior lighting for Dunns Wood Sewage Purification Works. Applications to Chief Architect and Planning Officer, Cumbernauld Hse, Cumbernauld, Glasgow, by above date.
- 15 Nov.—Rayleigh U.D.C.** Supply and erection of 14 Group "A" concrete columns and 28 sodium lamps/gear for A127 Southend Arterial Rd lighting.—See 3 Nov. issue.
- 15 Nov.—Wigston U.D.C.** Rewiring, etc., in council offices. Engineer and Surveyor, Bushloe Hse, Wigston, Leics. Deposit £2 2s.
- 16 Nov.—Dunbarton C.C. (1)** Erection and wiring only of 56 fluorescent lighting units in Seafar I area, Cumbernauld New Town; (2) Cabling erection and wiring only of 41 240 W Group "A" fluorescent lighting units for Ring Rd North Side, phase 1, at Cumbernauld. Applications to County Lighting Superintendent, W. Arthur, 24 George Sq, Glasgow C.2, by above date.
- 16 Nov.—Wigan B.C.** Electrical installations in 27 dwellings on Drummond Sq site.—See 3 Nov. issue.
- 17 Nov.—Belfast C.C.** Electrical installation in Assembly Hall, Dunkeld Gdns Modern Secondary School for Girls.—See 27 Oct. issue.
- 17 Nov.—Birmingham C.C.** Socket-outlet installations and lighting installation repairs in 250 houses at Acoc's Green.—See 20 Oct. issue.
- 17 Nov.—Darfield U.D.C.** Rewiring of 118 houses.—See 3 Nov. issue.
- 17 Nov.—Fylde Water Board.** Supply of flow recorder panel and hydraulic measuring equipment.—Advertised 13 Oct. issue.
- 17 Nov.—Glasgow T.C.** Supply of heavy canteen equipment for school kitchens, including: (1) fish fryer; (8) refrigerators; (9) food preparing machine; (10) hot cupboard; (11) potato peeling machine; (12) mixing machine; (13) meat slicer.—See 3 Nov. issue.
- 17 Nov.—Penybont R.D.C. (b)** 140 W sodium lighting on 25 ft columns scheme at Llangynydd. Engineer and Surveyor, Greenmeadow, Coity Rd, Bridgend. Deposit £2 2s.
- 18 Nov.—Breconshire C.C.** Electrical work at County Surveyor's Depot, Beili Bedw, Sunnybridge. Applications to County Architect, Rhyd Offices, Brecon, by above date.
- 18 Nov.—Hornchurch U.D.C.** Class "A" lighting, Trunk Rd A13; (1) resiting of 30 steel units and erection of 34 steel units; (2) supply of 34 steel columns; (3) supply of 83 lanterns; (4) supply of 83 sets control gear; (5) supply of 83 horizontal 400 W MBF/U lamps.—See 3 Nov. issue.
- 18 Nov.—Maldstone B.C.** Electrical installation in conversion of 107 Tonbridge Rd into an old people's hostel. Borough Engineer, Palace Ave.
- 18 Nov.—N.I. Housing Trust.** Plumbing, electrical and patent tile subcontract in 47 dwellings, Kary Hill, Downpatrick. Trust Offices, 12 Hope St, Belfast 12.
- 18 Nov.—Old Fletton U.D.C.** Improvement to Group "B" standard of 58 street lighting units. Surveyor, Council Offices, Old Fletton, Hunts.
- 19 Nov.—Flintshire C.C.** Compressor for charging B.A. cylinders.—See 3 Nov. issue.
- 19 Nov.—Halesowen B.C.** Supply and erection of 60 Class "A" and 770 Class "B" street lighting units on concrete or steel columns along various roads. Borough Engineer and Surveyor, Council Hse.
- 21 Nov.—Chertsey U.D.C.** Erection of 92 25 ft and 23 15 ft concrete columns plus 2 steel columns and installation of fluorescent, sodium, mercury and tungsten lighting and for dismantling 64 15 ft columns. Engineer and Surveyor, The Orchard, Staines La. Deposit £1 1s.
- 21 Nov.—Diss U.D.C.** Supply and installation of street lighting at Mere St, Diss. Engineer and Surveyor, Council Offices.
- 21 Nov.—Haverhill U.D.C.** Supply of 14 Group "B" 15 ft columns and lanterns suitable for tungsten or 80 W mercury lighting with chokes and control gear. Engineer and Surveyor.
- 21 Nov.—Morpeth R.D.C.** Electrical installations in 18 houses, Mitford.—See 3 Nov. issue.
- 21 Nov.—Nuneaton B.C.** Erection of 126 columns and wiring: 39 85 W and 35 60 W sodium and 52 100 W tungsten lamps. Borough Surveyor, Council Hse. Deposit £2 2s.
- 21 Nov.—Wednesfield U.D.C.** Supply, erection and wiring of 17 Group "A" Stanton 8F columns with mercury lighting and three Group "B" mercury equipments on columns to be supplied by U.D.C. Engineer and Surveyor, 1. A. Peacock, 29 Bolton Rd, Wednesfield. Deposit £2 2s.
- 22 Nov.—Musselburgh B.C.** Supply and erection of 66 15 ft and 15 25 ft concrete columns and installation of mercury and sodium lighting in various roads.—See 3 Nov. issue.
- 24 Nov.—Dublin.** Electrical installation in proposed pathological laboratory and mortuary building at Sir Patrick Dun's Hospital.—See 2 Nov. issue.
- 24 Nov.—Middlesex C.C.** Contract Sub. 39. Wiring, lighting and heating of power house at Deephams Sewage Wks, N.9, by contractors with d.c. experience. Contract includes supply of miscellaneous plant and an automatic telephone exchange.—Advertised 3 Nov. issue.
- 25 Nov.—Caernarvon B.C.** Supply and erection of 86 25 ft steel columns, complete with 140 W sodium lighting and supply only of 14 wall brackets with 140 W sodium lighting/control gear/time switches. Borough Engineer and Surveyor, Swyddfa'r Dref, High St.—Advertised in this issue.
- 25 Nov.—Manchester C.C.** Electrical installation in Harpurhey Technical High School for Girls.—See 3 Nov. issue.
- 25 Nov.—Woodford Green.** Applications for inclusion in (No. 4) list of approved electrical contractors to Group Secretary, Claybury Hospital, Woodford Gn, Essex, by above date.
- 28 Nov.—Aberdeen C.C.** Supply of lamps during 1961.—Advertised 3 Nov. issue.
- 28 Nov.—Lanark C.C.** Street lighting equipment for A8, Dewshill: (1) eight 280 W sodium lanterns; (2) 16 leak transformers; (3) 16 capacitors; (4) eight 35 ft columns with 9 ft outreach. Depute County Lighting Engineer, Hamilton.—Advertised in this issue.
- 28 Nov.—Lisburn. (a)** Electrical installation in Wallace High School extension, Antrim Rd. Details from Consulting Engineers McAuslan, Abbott and Ptnrs, 16 Bedford St, Belfast 2. Deposit £3 3s.
- 30 Nov.—Edinburgh.** Electrical engineering maintenance contract for year to 31 Dec, 1961, in hospitals for Rbyal Victoria and Associated Hospitals' Board of Management. Secretary and Treasurer, A. G. Weistead, City Hospital, Greenbank Drive, Edinburgh 10.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Celec" dimmers—makers of? T.E.—Curtis Manufacturing Co. Ltd., 26 Paddenswick Rd, Hammersmith, W.6.

"Rabicon" heating elements—makers of? L.E.B.—Controlled Heating Units (London) Ltd., Avenue Rd, Hampton, Middx.

Heat pumps—makers of? E.B.—Heat Pump and Refrigeration Ltd., Landowne La, Charlton, S.E.7; C.S.A. Industries Ltd., Wharf Rd, Warwick; Denco Miller Ltd., Holmer Rd, Hereford; Jonmil Building Developments Ltd., 16 Carlisle St, W.1; S. B. Jackson, 47 Streatham Hse, Streatham Hill, S.W.2.

"Signlite" floodlights incorporating fluorescent tubes—makers of? A.E.I.—Gowshall Ltd., 14 Lamb's Conduit Passage, W.C.1.

"Handy-Andy" hand dryers—makers of? T.E.—Quiz Electrics Ltd., 160 High St, Teddington, Middx.

"Gaylord Hauser" juice extractors—suppliers of? G.E.W.—Life and Beauty Ltd., 5 Avery Row, W.C.1.

ANSWERS WANTED

"Caryseier" sodium lighting fittings—makers of? C.A.M.—

"Vap" battery chargers—makers of? G.E.—

-Tottenham B.C. Supply of (Item 3) r year.—See 27 Oct. issue.

-Braintree and Bocking U.D.C. (1) of 112 Group "B" prestressed columns; (2) supply, erection and f 115 45/60 W sodium lanterns; cable ducts; (4) dismantling existing; (5) incidental works.—Ad-3 Nov. issue.

-Cambridgeshire C.C. Supply, erecting and fitting: (1a) nine 35 ft steel with 200 W sodium lighting at Caxet roundabout (A45 and A14); (1b) ft steel columns with 200 W sodium Four Went Ways roundabout (A11 4); (2) five 25 ft steel columns with W fluorescent lamps at Bury Toll near Newmarket (A11 and A45). Surveyor, Shire Hall, Castle Hill, ze.—Advertised in this issue.

-Chigwell U.D.C. (i) Supply of (a) columns and (b) lanterns/lamps; ion and installation of 21 200 W units for A11 No. 2 lighting scheme. Nov. issue.

-Manchester C.C. Supply and instal- outside lighting of existing aeration Davyhulme Sewage Wks.—Adver- lov. issue.

-Stockport B.C. 2. Electrical instal- roposed Welfare Clinic, Longford , Reddish.—See 3 Nov. issue.

-Kirkcaldy T.C. (b) Electrical work on of new hall at Links St.—See 3 ic.

-Matlock U.D.C. Supply and instal- mplete of nine sewage pumps at iping stations in Darley Vale.—See sue.

-Dunblane B.C. Supply and erection Group "A" concrete columns lan- iliary equipment, plus the resiting columns along A9. Burgh Surveyor, hmbrs.

-Oxford T.C. Supply and erection igh-lift 3,500 g.p.m. and two low- 0 g.p.m. pumps complete with switchgear and cabling. City Water , 65 St. Aldate's.

stated.—**Queensferry B.C.** Electrical erection of public lavatories and s stores and in alterations in High i houses. Details from Surveyors, Douglas and Co., 1 Douglas St, line.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

17 Nov.—Pakistan. One 3 ft by 2 ft by 2 ft 50 kW 1,003°C furnace. Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/28534/60).*

18 Nov.—S. Africa. 15 battery operated low elevating platform trucks, battery chargers and batteries for S.A. Railways. Chairman, Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (ESB/28586/60).*

18 Nov.—America. Disconnect switches (four items). Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Contract-Purchase Unit, Bldg 53, Denver Federal Center, Denver. B.o.T. (ESB/28420/60).*

18 Nov.—America. One five-panel unit control board for Rocky Reach H.E. Project. Public Utility District No. 1 of Chelan County, 327 North Wenatchee Ave, Wenatchee, Washington. B.o.T. (ESB/28476/60).*

21 Nov.—Pakistan. All-aluminium and a.c.s.r. conductor. Executive Engineer, Stores Electricity, Gharat Bldg, Lahore. B.o.T. (ESB/28592/60).*

23 Nov.—Australia. 2.2 kV supervisory switchgear. Secretary, Victorian Railways, Spencer St, Melbourne. B.o.T. (ESB/28173/60).*

23 Nov.—Egypt. Polishing apparatus, ovens and instruments for Suez Refinery. General Petroleum Organisation, 44 Sharia Abdul Moneim, Dokki, Cairo. B.o.T. (ESB/28573/60).*

24 Nov.—Pakistan. One 75 kW diesel-generating set. Deputy Director-General, Industries, Trade and Supply, P.I.D.C. Hse, Motijheel, Dacca. B.o.T. (ESB/28446/60).*

29 Nov.—Australia. 330 kV isolating and earthing switches complete with insulators, operating mechanisms and supporting structures. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/28109/60).*

30 Nov.—Rhodesia and Nyasaland. Three 1,000 kVA, two 500 kVA and three 750 kVA transformers. 8,100 ft 0.2 sq in. 3-core 11 kV armoured cable. 7/0-036 250 V. 0-0225 sq in. and 0-06 sq in. 660 V cable. Elec-

tricity Dept., Municipality of Umtali, Southern Rhodesia. B.o.T. (ESB/28587/8 and 9/60).*

1 Dec.—Pakistan. 17 items including instru- ments, arc-welding equipment and trans- former. Deputy Director-General, Industries, Trade and Supply, P.I.D.C. Hse, Motijheel, Dacca. B.o.T. (ESB/28447/60).*

7 Dec.—Pakistan. Six items, insulators. Mr F. Rizwi, Purchase Co-ordinating Officer, P. and T. Directorate-General, Block 32, Karachi. B.o.T. (ESB/28532/60).*

7 Dec.—Pakistan. (1) Two 75 kW, (2) four 50 kW and (3) two 40 kW diesel generators, complete with switchgear. Deputy Director-General, Industries, Trade and Supply, P.I.D.C. Hse, Motijheel, Dacca. B.o.T. (ESB/28445/60).*

14 Dec.—Australia. Two 11/66 kV, 1,500 kVA, 3-ph. transformers and two 66/11 kV, 1,000 kVA, 3-ph. stepdown transformers. Secretary, State Electricity Commission, 447 Gregory Terr, Brisbane. B.o.T. (ESB/28150/60).*

15 Dec.—S. Africa. Eight ultrasonic crack, etc., detectors for S.A. Railways. Chairman, Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (ESB/28549/60).*

15 Dec.—S. Africa. Cables and accessories for Athlone Power Station "A" extension. City Electrical Engineer, Strand St, Cape Town. B.o.T. (ESB/28590/60).*

CONTRACTS PLACED

Admiralty. Renewal of cables in York- shire, Sturrock Power Installations, Edin- burgh.

Bradford C.C. Electrical work on Holme Wood estate, J. Carter and Sons (Bradford) Ltd, £2,017. Recommended.

Bury B.C. Electrical installation in Public Library, Yewsons (Electrical Contracting).

Hale U.D.C. Installation of 210 mercury lighting units, 15 ft concrete columns, Con- crete Utilities Ltd.

Hendon B.C. Lighting and heating instal- lation in Edgware Branch Library, Graham and White Ltd, £3,350. Recommended.

Lisburn U.D.C. Supply and erection of improved fluorescent street lighting, A.E.I. Ltd, £4,861.

London C.C. Provision of sewage pumping plant for new pumping station Holland Gdns, Kensington, Gwynnes Pumps Ltd, £11,484.

Manchester Hospital Board. Fire alarm instal- lation at Hope Hospital, Salford, Engi- neering Services Ltd; £32,783; mains cabling at Calderstones Hospital, Whalley, North Western E.B., £4,646. Recommended.

Romford B.C. Electrical installations in 16 houses and 24 flats at St. Andrews Rd and Queen St, K. J. Bromley, £1,560. Recom- mended.

South Shields T.C. Electrical work in erection of new Biddick Hall County In- fants' School, C. Ramsay and Son, £2,730 15s 6d. Recommended.

TRADE NOTES

of address. Philco (Gt. Britain) ource that all sales correspondence ow be addressed to 21 Cavendish Telephone: Langham 9291.

gh Contracts Ltd. have moved to ridge Rd, Hatch End, Middlesex. e: Hatch End 6564.

of Name. The title of Dowty s Ltd., has been changed to Dowty Ltd.

Telephone No. The telephone no. of try of Aviation, at Shell Mex Hse, changed to Temple Bar 1207.

r. With the progressive transfer to of several electronics departments Malmesbury factory of E. K. Cole company has expanded its electric oducts at Malmesbury to where the Design Dept has also moved.

Elkay Electrical Manufacturing have appointed Mr V. Mercer of ercer (Agencies), 45 Castle St, Bel- heir selling agent in N. Ireland.

on. The Glacier Metal Co Ltd, ntly extended their Manchester fac- some 10,000 sq ft. and equipped it number of special purpose heavy to undertake the repair and manu- f an increased range and volume of e-metal plain bearings.

ecorders. A new company—Mood- 3t. Britain) Ltd.—has been formed the signing of an agreement be- e Conley Electronics Corp., of and GBC Electronic Industries

Ltd, the British company marketing Clarion transistorised tape recorders in the UK. Moodmaster (Gt. Britain) Ltd, in which GBC and Elizabethan (Tape Recorders) Ltd hold the controlling interest, has been set up to handle the Conley Corporation's Mood- master continuous background music system in this country. The firm is to open show- rooms, in Belgravia, but meanwhile inquiries are being dealt with at 32 Portland Pl, Lon- don W.1.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Acme. 791,775. Class 9. Vacuum cleaners. Acme Domestic Equipment Ltd, 97 David St, Glasgow S.E.

Hynerfil and Hyperlam. B803,097/8. Class 17. Resin-impregnated glass fibre fabrics, etc. **Hyperseal and Hypertape.** B803,099/100. Class 17. Insulating tapes, etc. Insulated Sleeveings and Tapes Ltd., Electron Wks, Brook St, Preston, Lancs.

I.R.C. 781,403. Class 9. Electric resis- tances. International Resistance Co., 401 North Broad St, Philadelphia 8, Penn., U.S.A.

Kestrel. 802,038. Class 9. Electrical apparatus and instruments, etc. 802,039. Class 11. Lamp holders, lighting fittings and electric radiators, etc. Kestrel Engineering

Co. Ltd., 222 Soho Hill, Handsworth, Bir- mingham 19.

Lepad. 806,241. Class 9. Connections for coils. Lepad, 13 Dalton Ave, St. Helen Auckland, Bishop Auckland.

Lustrand. 805,757. Class 9. Microphones. Lustraphone Ltd., St. George's Wks, Regent's Pk Rd, N.W.1.

Minx and Nymph. 802,017 and 8. Class 7. Dish-washing machines. Commodore Eng. Ltd., 2a Station Rd, Manor Pk, E.12.

Neptune. 805,522. Class 12. Horns, hooters, etc. Clear Hooters Ltd., Bedworth, Nuneaton, Warwicks.

Suppressovla. 803,916. Class 9. Insulated cables and wire; resistance wire and cables all having interference suppressing properties and interference suppressors. Ward and Goldstone Ltd, Sampson Wks, Frederick Rd, Pendleton, Manchester 6.

BUSINESS PROSPECTS

Aberdeen. N.E. Hospital Board, 1 Albyn Pl, approve £152,000 out-patients' department at Sick Children's Hospital, Westburn Drive.

Basildon. Hoskins and Son (Essex), Rayleigh, contractors for Transformer and Electrical Co's extensions.

Bexhill. Struth and Co, 77 George St, W.I, surveyors for block of seven-storey shops, flats, etc, Marina, Devonshire Rd, and Eversley Rd.

Birmingham. London and Birmingham Investment Co. plans 34-storey building on The Ringway.—T.C. Tender: Contract 691, 13 one- and two-storey dwellings, Northfield; and Contract 725, 11 two-storey dwellings, Bartley Green. Architect. Contract 749, four children's homes and 15 two-storey dwellings, Bartley Green and West Heath. Architect.

Bishop Auckland. C. Robson and Son, Sutton Chmbrs, 245 Newgate St, Bishop Auckland, architects for Foster and Sons' new tinplate factory.

Bournemouth. Major A. G. McCall, Christchurch Rd, plans three blocks of 74 flats in Christchurch Rd.

Brighouse. The Thornhill Yorkshire Estate Co., 1 Princess St, Huddersfield, plan housing development, Carr Green La.—British MonoRail Ltd. plan offices and factory extensions, Cengar Wks, Wakefield Rd.

Brighton. Samsons Associated Companies, 141 Moorgate, E.C.2, plan 96 flats on Cliveden site, London Rd.

Bristol. Hicks and Dewfall (Bristol), 48 Court Rd, Oldham Common, Bitton, Bristol, to develop land for 33 houses at rear Air Balloon Rd.

Bromley B.C. Tender: 104 flats Turpington La. Engineer.

Cambridge. East Anglican Regional Hospital Board, Cambridge, plan £910,500 psychiatric hospital at Fulbourn.

Cardiff. Frixia, Apex Blds, West Canal Wharf, plan development of East Canal Rd land.—BBC, Portland Pl, W.I, plan buildings at Llandaff.

Chelmsford. Cooper Estates, Wilmington Hse, Wilmington, Kent, plan 108 houses and garages at Beechenlea estate.—Percy Bilton, 54 Uxbridge Rd, Ealing, W.5, plan 18 New Springfield Park estate houses.—R. W. Chandler and Son, 89 Widford Rd, plan block of three-storey dwellings, 93 Moulsham St.—Mr Roff Marsh, 125 London Rd, architect for £55,000 new house units at Essex Home School, Rainsford Rd.

Chester-le-Street. S. Solomon, 30 St. Mary's Pl, Newcastle, plans showrooms and offices at North Burn.

Chesterfield. R. Brown (Gleadless), 169 White La, Sheffield 12, and P. Hassall, 134 Sheffield Rd, Dronfield.

Chippenham. Lackham School of Agriculture to be extended.

Colchester.—E. C. P. Brand, The Central Wks, High St, Braintree, Essex, plans 30 Tey Rd houses.

Corby U.D.C. Several hundred houses planned on Brookside and Mantlefield estates. Surveyor.

Coventry. Dolphin Developments, Duncan Hse, Dolphin Sq, S.W.1, plan 114 flats in 13-storey block and two blocks of three-storeys at Allesley Hall Drive and Allesley Old Rd.

Croydon. Kenneth Anns and Ptnrs, 1 Lincoln's Inn Fields, W.C.2, architects for 23 flats on site of 78 Augustine's Ave, for Abasic Ltd.—Lawdon Developments, 157 Victoria St, W.1, plan 66 flats at 62 Addiscombe Rd, etc.—B.C. Tender: 234 dwellings in two, three and four-storey blocks. Engineer.

Darlington. R.C. Authorities plan new school, Central Ave, Newton Aycliffe.

Doncaster. W. Elland and Son, St. Sepulchures Gate, plan erection of new shops and offices on site of their store.

Dublin. Michael Scott and Assoc, 19 Merrion Sq, Dublin, architects for £4 million television headquarters at Montrose, Stillorgan Rd, for Radio Eireann.

Durham. Marshall Sisson, Farm Hall, Godmanchester, Huntingdon, architect for £100,000 residential block of St. Mary's College for Durham University.

Essex. £52,615 recreation block planned at Institute of Agriculture.

Felixstowe. B. A. Hatcher, 1 Arcade St, Ipswich, architect for E.A. Hospital Board's alterations and additions to Felixstowe General Hospital.

Gateshead. £30,500 youth and community centre planned, Lobley Hill. Engineer.

Gravesend. Fleetwood, Buss and Anns, 4 Verulam Bldgs, Gray's Inn, W.C.1, quantity surveyors for £130,000 store premises for Chicsmans of Gravesend.

Great Yarmouth. Olley and Haward, 5 Queen St, Gt. Yarmouth, architects for X-ray department and adaptation of old kitchen premises at Northgate Hospital.

Grimsby R.D.C. Lighting improvement planned, North Sea La, Humberson. Surveyor.

Hastings. Nicholson and Ruston, 2 New Sq, Lincoln's Inn, W.C.2, architects for seven-storey block of 14 flats, Grand Parade, for H. Fairweather and Co.—A. C. Draycott, High St, Lancing, Sussex, surveyor for Stage 3 of development of Alexandra Park estate for Hillview Estates.

Henley-on-Thames. Thomas R. Hancock, c/o John Morton and Ptnrs, 1 Church La, Wallingford, Berks, architect for 186 Paradise Row dwellings for Townmakers Ltd.

Hereford. Property Investments (Middlesex), 11 Park Pl, S.W.1, plan shops and offices, Broad St.

Heston and Isleworth. B. N. Whitespinner Ltd, 640 London Rd, Isleworth, plan 14-storey office block with underground car park at London Rd/Worton Way junction.

Hove. R. Green (Properties), Duke St, plan 58 flats on Hangleton site.

Jarrow. Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, Co. Durham, architects for Danesfield Maternity Home extensions.

Liverpool. Lord St Investments Ltd, plan 16-storey building, Queen's Sq.—The Fire Salvage Association of Liverpool, Johnson St, Liverpool 3, plan new Derby Rd headquarters.

London. O. E. Parratt, Adelaide Hse, London Bridge, E.C.4, quantity surveyor for Birds Eye Foods' Lower Sydenham cold store.—T. Wall and Sons (Ice Cream), The Friary, Acton, W.3, plan canteen and office block.—Geo Cohen 600 Group, plan offices and canteen building, 23-25 Sunbeam Rd.—George Head and Co, 40 Baker St, W.1, architects for £160,000 industrial building at 31 Brewery Rd, N.7, for Woburn Studios.—Sydney Clough, Son and Ptnrs, 39 Devonshire St, W.1, architects for new Stepney Way dental block for London Hospital, Whitechapel, E.1.—Rebuilding of war-damaged wing, etc, at Guy's Hse, St. Thomas St, S.E.1, planned.—Playne and Lacey, 19 Queen Anne's Gate, S.W., architects for five-storey nurses' hostel at Holland Park, W, sponsored by King Edward VII Hospital Fund.—D. M. Blouett, 3 Ashley Pl, S.W.1, architect for £112,000 extensions at St. George's R.C. School, Shenshall St, E.17.—C. Lovett Gill and Ptnrs, 41 Russell Sq, W.C.1, architect for 12-storey shops/office block on site of 2-8 Victoria St, S.W.1.—Royal Institution of Chartered Surveyors, 12 Gt George St, S.W.1, plan new building to provide headquarters, Government and Commonwealth offices, etc.—City of London Real Property Co, 16 Mark La, E.C.3, plan ten-storey building at Warwick Rd and Allington St, Westminster.—T. M. Burrows and Ptnrs, 44 Bedford Row, W.C.1, architects for block of Oxford St, W.1, offices.—Ronald Ward and Ptnrs, 29 Chesham Pl, S.W.1, architects for eight-storey offices/flats

block at Tottenham Court Rd and Grafton Way, W.1.

Lowestoft. The Zephyr Engineering Wks, Freemantle Rd, plan offices.

Maldstone. Wallis Gilbert and Ptnrs, 5 Cromwell Rd, S.W.1, architects for plate making and lithography building, Towl Printing Wks, Farleigh Hill, for Alabaster Passmore.—A. J. Townsend and Co, Lulworth, Maldstone Rd, Chatham, plans 40-flat block, 12-flat block and two blocks of terrace houses, James St.—New Thornhill Estates, Foley Hse, Sittingbourne Rd, Maidstone, plan 90 flats in three-storey blocks, Foley House site, Sittingbourne Rd.

Malling R.D.C. Tender: 116 dwellings, Ditton Park. Engineer and Surveyor.

Manchester. P and H. Bailey, Lord St, plan factory and offices at Chatley St.

Mere and Tisbury R.D.C. Tender: 61 dwellings, comprising two schemes. Clerk.

N. Ireland. Franklin and Son, Coventry, plan 19,000 sq ft area factory at Banbridge.—Ministry of Commerce (N.I. Govt.) plans 73,000 sq ft factory at Lisburn for Bridgeport Brass Co., Connecticut.

Newcastle. £400,000 extensions planned for Students' Union, King's College.—Spence and Price, 26 St. Mary's Pl, architects for £126,000 Kenton Secondary School.

Northumberland C.C. £5,400 annexe to Ralph Allan Home, Warkworth, planned. Architect.

Nottingham. £1 million multi-storey casualty block planned at General Hospital.

Pembroke Dock. P. and M. White, Arcade Hse, 27 Old Bond St, W.1, architects for convent on site of London Hse.

Peterlee. W. H. Williamson and Ptnrs, 7 St. Mary's Pl, Newcastle, architects for four-storey office block and five two-storey shops in Town Centre for Peterlee Development Corporation.

Poole. Farmer and Dark, Romney Hse, Tufton St, S.W.1, architects for factory extensions at Loewy Engineering Co's Wallisdown Rd factory.

Preston. Ardin and Brookes and Ptnrs, 6 Cavendish Pl, Cavendish Sq, W.1, architects for town hall site shopping centre for Calgary and Edmonton Land Co.

Prudhoe U.D.C. 84 houses planned on Council estate at West Wylam. Architect, J. M. Angus, 3 Gallowgate, Newcastle.

Ramsgate. B.C. plan conversion of street lighting to electricity in area 1b and 2a at £8,860 and £3,021, respectively.

Sheringham U.D.C. Replacement of gas by electric street lamps. Surveyor.

South Shields. Page, Son and Hill, 75 King St, architects for St. Oswald's School.

Southall. Abbott Bros. (Southall), Brookside Wks, Hayes Bridge, Uxbridge Rd, Hayes, plan five-storey block at High St.

Southport. The Pearl Assurance Co, High Holborn, W.C.1, plan three-storey offices on Lord St.

Stanley. Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, architects for eight bungalows, ten houses at Kip Hall Estate and private Hill Top housing estate, East Stanley.

Sunderland. P. J. Stienlet and Son, Queen Sq, Newcastle, architects for R.C. primary school, St. Luke's Rd, Pennywell. Newcastle Regional Hospital Board, Bedford Rd, Newcastle, plan conversion of nurses' home to laboratories at Royal Infirmary.

Surbiton. E. Firmin and Ptnrs, Thavies Inn Hse, Holborn Circus, E.C.1, architects for £175,000 factory at Cox Rd, Hook.

Sutton. Riches and Blythin and L. C. Holbrook, 16 Northumberland Ave, W.C.2, architects for £65,000 offices, St. Nicholas Rd.

Titchfield. The Plessey Co, Swindon, Wilts, plan takeover of 66-acre former RAF station.

Torquay. Houserenters Investments, Church Rd, St. Marychurch, plan 12-storey block of 72 flats at Castle Cary site.

Prospects—Continued

send. W. E. Edwards and Ptnrs, 5 ont Bldgs, Newcastle, architects for ton County Junior School.—The rn Coal Board, Whitley Rd, Long, plan new offices. Rising Sun Col- Own architects department.

ford. Gilbert Ash, 2 Stanhope Gate, ontractors for £150,000 City Hse Pro- shops and offices.

Hartlepool. F. B. Swainston, 14 Bank, Marton, Middlesbrough, ct for Gales Motors' rebuilding and on scheme.—T.C.: 204 houses, Owton Estate planned. Architect.

Windsor. John Laing Housing Co, Mill Hill, N.W.7, plan four-year scheme for 46 detached and 198 semi-detached houses in six three-storey blocks, Butlers Farm, Ded- worth Rd.

Woking. Ponwood Ltd, plan redevelop- ment of Grand Theatre corner with six- storey block of shops, offices, etc.

Wolverhampton. Tender: Erection of In- stitution for the blind and disabled head- quarters and workshops, Sedgley. Quantity surveyors, Henry Vale and Sons, 47 Water- loo Rd, Wolverhampton.

Worcester. T.C. Tender: 171 Warndon estate dwellings. Engineer, 22 Bridge St.

Official Receiver's Office, West Africa Hse, 25 Water St, Liverpool 2, and public examination: 11 a.m., 16 Jan., at Court Hse, Crawford St, Wigan.

York. M. W. P. Walsh, electrical goods dealer, formerly carrying on business at 59 Holgate Rd. Public examination: 10.30 a.m., 8 Dec., at Law Courts, Clifford St, York.

Croydon. T. G. Davison, electrical dealer, carrying on business as Woolwich Vacuum Supplies, 14 Perry Hall Close, Orpington. First meeting: 11.30 a.m., 11 Nov., at 58-61 York Terr, Regent's Pk, N.W.1; and public examination: County Court, Scarbrook Rd, Croydon.

Intended Dividend

Croydon. H. F. Mouncey, electrical en- gineer, of 4 Cromer Rd, S.W.17. Last day for receiving proofs for intended dividend: 11 Nov., to trustee: W. J. W. Hill, 58-61 York Terr, Regent's Park, N.W.1.

Dividend

Bradford. M. R. Dixon, plumber and electrical contractor, formerly carrying on business at 792 Leeds Rd. Dividend per £: 2s 10½d, payable on 11 Nov., at 36 North Parade, Bradford.

Rescinding Order

Halifax. G. H. Collins, electrical engineer, lately carrying on business at Astoria Bldgs, Brighouse. Receiving order dated 27 Aug., 1958, rescinded as from 4 Oct.; all debts paid in full.

Application for Discharge

Exeter. B. G. Slater, electrical engineer, formerly carrying on business at 12 George St, Exmouth. Application for discharge to be heard at The Castle, Exeter, on 24 Nov., at 2 p.m.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Electrical Eng. Ltd. Resolution for arily winding-up passed at extra- rary general meeting on 23 Sept.

trahome Ltd. Meeting of creditors to d at Bonnington Hotel, Southampton W.C.1, on 15 Nov., at 3 p.m. Secured rs to send details to registered office company by 4 p.m., 14 Nov.

lectric Appliance Co. Ltd. Creditors i details to liquidator: R. W. Hellyer, rton Chmbrs, Westgate, Leeds 1, by .

lo Electrical Appliances Ltd. General g of members to be held at 9 Mans- t, W.1, on 24 Nov., at 11 a.m., to e liquidator's report.

es Electricals Ltd. Meeting of credi- be held at 112 Crescent Rd, Reading, on 14 Nov., at 3.15 p.m.

Domestic Appliances (Dalston) Ltd. n for winding-up to be heard before igh Court of Justice, Strand, W.C.2, Nov. Persons intending to appear to J. E. Baring and Co., Bank Chmbrs, a St, W.C.1, by 1 p.m., 12 Nov.

rie Ltd. Petition for winding-up to rd before the High Court of Justice, W.C.2, on 14 Nov. Persons intending ear to notify Coward, Chance and St. Swithin's Hse, Walbrook, E.C.4, .m., 12 Nov.

res Electrical and Radio Co. Ltd. n for winding-up to be heard before igh Court of Justice, Strand, W.C.2, Nov. Persons intending to appear tify M. G. Whitmore, King's Beam Mark La, E.C.3, by 1 p.m., 12 Nov.

ost Electronic Controls Ltd. Petition nding-up to be heard before the High of Justice, Strand, W.C.2, on 14 Nov. s intending to appear to notify on, North, Harley and Co., 6 York Adelphi, W.C.2, by 1 p.m., 12 Nov.

Electric (Middlesbrough) Ltd. Meet- creditors to be held at Wellington Albert Rd, Middlesbrough, on 18 at 11 a.m. Secured creditors to send to registered office: 283 Linthorpe fiddlesbrough, before the meeting.

larro and Woods Ltd. Mr L. H. n, 31 Lloyd St, Manchester 2, and . A. Hawken, 1 John St, Bedford W.C.1, appointed joint liquidators at rdinary general meeting on 25 Oct.

anles Winding-up

ram Wells (Agencies) Ltd., lately g at 3a The Terrace, Wokingham, agents for electrical goods.

statement of affairs submitted by Mr showed unsecured liabilities of £5,832 b trade accounts) and preferential of £34, while assets were valued at

company's business was mainly that nufacturers' agents selling electrical to manufacturing concerns (and some- ther employees) at discount rates, / about 15% below retail price. Mr attributed the failure of the company t of capital and to his own commercial rience.

BANKRUPTCY ACTS

Receiving Orders

Bradford. P. W. Nelson, electrical retailer and engineer, formerly carrying on business as S.R. Services at 543 and 551 Wakefield Rd and at 4 and 32 Town Gate, Wyke, Bradford. Receiving order dated 27 Oct.

Leeds. H. G. Duff, radio, television and electrical dealer, carrying on business at 7 Canal Rd and 8 Dodsworth Court, Leeds. Receiving order dated 27 Oct.

Oxford. T. Last, electrical dealer, trading as Oxford D.A. Specialists, 33 Cowley Rd. Receiving order dated 26 Oct.

First Meetings and Public Examinations

Wigan. J. Ball, electrical contractor, formerly carrying on business at 36 Crompton St. First meeting: 11.30 a.m., 10 Nov., at

MEETINGS TO NOTE

THURSDAY, 10 NOV.

I.E.E. (Utilisation Section). "The Logmotor—A Cylindrical Brushless Variable-Speed Induction Motor," Professor F. C. Williams, E. R. Laith- waite, J. F. Eastham and L. S. Piggott. "Brushless Variable-Speed Induction Motors Using Phase-Shift Control," Professor F. C. Williams, E. R. Laithwaite, J. F. Eastham and W. Farrer. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (W. Wales). "The Shielding of Over- head Lines Against Lightning," J. H. Gridley. Conference Room, S. Wales Electricity Board, The Kingsway, Swansea. 6 p.m.

INSTITUTION OF CIVIL ENGINEERS. Discussion: "The Economics of Airlifts for Major Con- struction," Gt. George St, S.W.1. 5.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (N. Midlands). "Machine Tool Control," C. J. Charney. Queen's Hall, Grand Hotel, Leicester. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liver- pool). "Some Recent Advances in Radiation Pyrometry," B. W. Barley. M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scot- tish). V.H.F. AM/FM Transistor Receivers," H. A. Heins. Institution of Engineers and Ship- builders, Elmbank Cres, Glasgow. 7 p.m.

A.S.E.E. (Bradford and District). "Power Transformers," J. Bennett. Midland Hotel. 7.30 p.m.

A.S.E.E. (S.W. London). "Under-floor Heating," L. Bishop; and "Maintenance of an Electro- plating Plant," B. Mitchison. Prince of Wales Hotel, S.W.19. 8.30 p.m.

FRIDAY, 11 NOV.

I.E.E. Joint meeting with Royal Aeronautical Society. "The Future of 'Electrics' and 'Electronics' in Aircraft and Guided Missiles," The Rt Hon The Viscount Caldecote. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Tees-side). Annual dinner and Reunion, Zetland Hotel, Saltburn-by-the-Sea. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. "Railway Signalling Problems in a.c. Traction Areas," H. J. N. Riddle. Peppys' Hse, 14 Rochester Row, S.W.1. 7 p.m.

E.P.E.A. (Meter Engineers' Technical Group). Discussion: "Prepayment Methods," Caxton Hall, Westminster, S.W.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Mid- lands). "The Common-sense Approach to Instru- ment Manufacture," C. E. T. Cridland. Lecture Theatre of the Byng Kendrick Suite, at the Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

E.I.B.A. BALL at Grosvenor Hse, at 7 p.m.

MONDAY, 14 NOV.

I.E.E. (Electronics and Communications Sec- tion). Discussion: "Tunnel-Diode Application and Circuitry," Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). "Teaching and Learning Machines," C. E. G. Bailey. Joint meeting with the North Western Association of the Institution of Civil Engineers. Town Hall, Chester. 6.30 p.m.

I.E.E. (Western). "The Measurement Basis of Electricity Supply Metering," J. W. Skinner. South Wales Institute of Engineers, Cardiff. 6 p.m.

I.E.E. (N.E. Measurement and Electronics). "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. A. Setterington. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (E. Anglia). "The Oral Presentation of Scientific Material," A. Clow. Technical College, Cambridge. 6.30 p.m.

I.E.E. (S. Midlands Supply and Utilisation Group). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. College of Technology, Gosta Green, Birmingham. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Ind. Admin. and Eng. Production Group). Discussion: "Adhesives Engineering," Birdcage Walk, S.W.1. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Man- chester). "Intrinsic Safety Requirements," H. C. Lister. College of Science and Technology, Sackville St. 6.45 p.m.

I.E.S. (Sheffield). "History of Lighting," J. W. T. Walsh. Grand Hotel. 6.30 p.m.

PUBLIC WORKS AND MUNICIPAL SERVICES EXHIBITION at Olympia until 19 Nov.

JUNIOR INSTITUTION OF ENGINEERS (Sheffield). President's address: "Some Recent Developments in Public Electricity Supply," A. Haddock. Livesey Clegg Hse, 44 Union St. 7.30 p.m.

A.S.E.E. (Bournemouth and District). "Stage Lighting," Grand Hotel, Firvale Rd. 8 p.m.

A.S.E.E. (Central London). "Panelc Under- floor Heating," E. A. Money Penny. White Hall Hotel, Bloomsbury Sq, W.C.1. 7.15 p.m.

A.S.E.E. (N.W. London). "Variable Speed Drives," V. W. Press. Century Hotel, Wembley. 8.15 p.m.

TUESDAY, 15 NOV.

I.E.E. (Measurement and Control Section). "Discrete Analogue-Computer Compensation of Sampled Data Control Systems," T. Glusharov. Savoy Pl, W.C.2. 5.30 p.m.

Meetings to Note—continued

I.E.E. (N.W. Measurement and Control Group). Lecture: "The Behaviour of Protective Current Transformers Under Fault Conditions," J. W. Hodgkins. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (Scottish). Centre Dinner-dance. Grosvenor Restaurant, Glasgow. 6.30 p.m.

I.E.E. (N. Midlands Utilisation Group). "Electricity in the Manufacture of Hydrogen Peroxide," B. E. A. Vigers and R. O. Fletcher. Bradford Institute of Technology. 6.30 p.m.

I.E.E. (Southern). "The Shielding of Overhead Lines Against Lightning," J. H. Gridley. Technical College, Farnborough. 6.15 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). Electronics and Communications Section, Chairman's Address: "Channelling—A Sketch," T. B. D. Terroni. Cavendish Laboratory. 8 p.m.

I.E.E. (N. Staffs Graduates and Students). "Interference Between Communications and Power Circuits," E. J. Waddon. Stafford.

I.E.E. (Southern Graduates and Students). "Power Distribution," K. P. Boxal. C.E.G.B. Offices, High St, Portsmouth. 6.30 p.m.

I.E.S. (Liverpool). "Ship Lighting Perils and Prospects for the Lighting Engineer," J. T. Grundy and C. H. Vaughan. Electrical Industrial Development Centre of the Merseyside and N. Wales E.B., Paradise St. 6 p.m.

A.S.E.E. "The Application of Transistors and Other Semiconductor Devices in Industry," D. D. Jones and E. Jackets. Magnet Hse, Kingsway, W.C.2. 6.30 p.m.

A.S.E.E. (E. Kent). "Television Broadcasting Engineering," L. G. Dye. Clarendon Hotel, Broadstairs. 8 p.m.

A.S.E.E. (Oxford and Districts). "Electrical Aids to Labour Saving in the Home," Miss Lois Stevens. Employment Exchange. 8 p.m.

A.S.E.E. (W. Kent). "Railway Electrification." Rose and Crown Hotel, Tonbridge. 7.30 p.m.

WEDNESDAY, 16 NOV.

I.E.E. (Supply Section). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S. Western). "The Post Office Type 10P Valves for Submarine Telephone Repeaters," F. H. Reynolds. S.W.E.B. Electric Hall, Torquay. 3 p.m.

I.E.E. (Sheffield). "A Survey of Street Lighting and Its Future," W. R. Stevens and H. M. Ferguson. University, Mappin St, Sheffield. 6.30 p.m.

I.E.E. (S. Midlands). Faraday Lecture: "Transistors and All That," L. J. Davies. Temple Speech Room, Rugby. 6.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Education Group). "Teaching of Metallurgy to Engineers," Professor J. G. Ball. Birdcage Walk, S.W.1. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Computer Group). "Digital Computing Elements for Instructional Use," Lt-Col I. W. Peck. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Merseyside). "The Design of High Quality Sound Reproducing Equipment," R. T. Lakin, K. Davin and F. C. Gibson. The Adelphi Hotel, Liverpool. 7 p.m.

A.S.E.E. (Nottingham). "Electrical Thermal Storage Heating," P. G. Cope. Nottingham Mechanics Institution, Trinity Sq. 7.30 p.m.

A.S.E.E. (Wolverhampton and District). "Photo-electric Control Equipment in Industry," C. J. Teece. Chamber of Commerce, District Bank Chambers, Lichfield St. 7.45 p.m.

ELECTRICAL ASSOCIATION FOR WOMEN. "Plastics in the Home," M. Kaufman. I.E.E., Savoy Pl, W.C.2. 2 p.m.

THURSDAY, 17 NOV.

I.E.E. (Southern). "Engineering Education of the Technical Universities in Western Germany," D. B. Welbourn, Professor D. B. Spalding and G. L. Ashdown. (Joint meeting with Southern Branch of I.Mech.E.). Central Electricity Generating Board Offices, 111 High St, Portsmouth. 6.30 p.m.

I.E.E. (Irish). "Aviation, Navigational Systems," G. Jones. Physical Laboratory, Trinity College, Dublin. 6 p.m.

CHELMSFORD ENGINEERING SOCIETY. "Engineering Aspects of the Zeta Project," P. B. Clarke. Crompton's Social Hall. 7.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Blackburn). "The Automatic Control of Level in Boilers," C. G. Scolding. Castle Hotel. 7.30 p.m.

DIESEL ENGINEERS AND USERS' ASSOCIATION. "The Practical Application of Torque Converters," R. G. Hill. Institute of Marine Engineers, 76 Mark La, E.C.3. 2.30 p.m.

S. WALES INSTITUTE OF ENGINEERS. "The Application of Electrical Engineering Principles in a Modern Tinplate Industry," J. Nelsey. Park Pl, Cardiff. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Control Section). "The Control of a Single Effect Concentrating Evaporator—Dynamic Characteristics and Analogue Computer Study," F. P. Lees, L. W. A. Glasson and J. A. Anderson. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Grange-mouth). "Spectrophotometers," R. A. C. Isbell. Leapark Hotel. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). "Instrumentation in the Red-Brick Industry," M. E. C. Stedham. University of Bristol, Dept. of Physics, The Royal Fort. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (E. Midlands). "The Wavelength Standard of Length," K. J. Hume. Derby and District College of Technology, Kedleston Rd, Derby. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Newcastle). "The Evaluation of Industrial Instruments," D. M. Bishop. Conference Room, Roadway Hse, Oxford St. 7 p.m.

FRIDAY, 18 NOV.

I.E.E. (N. Midlands). Annual dinner. Queen's Hotel, Leeds. 7 p.m.

I.E.E. (N. Staffs). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Technical College, Stoke. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS. Chairman's address: "Simple Instruments for Tanks and Pipelines," E. M. Baskerville. Pepys' Hse, 14 Rochester Row, S.W.1. 7 p.m.

MONDAY, 21 NOV.

I.E.E. (N. Western). Discussion: "The Teaching of Electrical Network Theory and Its Applications of Electrical Engineering." Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Eastern). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (W. Utilisation Group). "The Characteristics and Protection of Semiconductor Rectifiers," D. B. Corby and N. L. Potter. South Western Electricity Board Demonstration Theatre, Old Bridge, Bath. 6 p.m.

I.E.E. (Sheffield). "Subscriber Trunk Dialling," D. A. Barron. Angel Hotel, Brigg. 7 p.m.

I.E.E. (Reading). "Electronics in the Postal Mail Services," G. P. Copping. George Hotel, King St. 7.15 p.m.

I.E.E. (London Graduates and Students). "Magnetic Amplifiers in Power Engineering," M. J. Pope. Savoy Pl, W.C.2. 6.30 p.m.

BIRMINGHAM ELECTRIC CLUB. "The Fuel Cell—A Logical Development in the Conservation of Natural Resources," P. W. Jones. Grand Hotel. 6.15 p.m.

I.E.S. (Bath and Bristol). "Lighting for Production," W. Guscott. S.W.E.B. Demonstration Theatre, Bristol.

I.E.S. (Leeds). "Eye Strain and Glare Disabilities in Relation to Artificial Lighting," G. Black. British Lighting Council, 24 Aire St. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. "50 c/s Single-phase A.C. Electrification on British Railways," J. W. Gr. eve. Electric Hse. 7.15 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Avonbourne Electrical Co. Ltd., 12 Parkstone Rd, Poole, Dorset. Nom. cap.: £5,000. Dealers in domestic and household appliances, etc. Dirs.: Peter E. Wren and Ernest F. Spinney.

E. Booth and Son Ltd., 82 Abbey St, Nuneaton. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £2,000. Dirs.: Edwd. Booth and Alexina M. Booth.

B. Butler (Ripon) Ltd., 4 High Shellgate, Ripon. Manufacturers of and dealers in radio and electrical apparatus, etc. Nom. cap.: £4,000. Dirs.: Benjamin Butler and Mrs Joan M. Butler.

Alex Coleman Ltd. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Dirs.: Alexander E. Coleman and Irene Coleman, Nyima, Buller Rd, Thornton Heath, Surrey.

Demalco Ltd., 6 Surrey St, W.C.2. Manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £100. Dirs.: To be appointed by subs. Subs.: Stanley H. Lucas and Francis A. Dean.

Don and Dearn Electrical Ltd., Waterside Mills, Greenfield, Oldham. Nom. cap.: £100. Dirs.: Rupert E. T. Nichols and Roger M. Tomson.

Electrical Contractors (Manchester) Ltd., 19 Great Ducie St, Manchester 3. Nom. cap.: £500. Dirs.: Albert W. S. Little and Albert V. Little.

E.W.N. Electrics Ltd. Nom. cap.: £1,000. Dirs.: Ernest Nott and Mrs Eleanor M. Nott, 15 Hazelmere Close, Bedford, Feltham, Middx.

G.W. Electrical Ltd., 123 Pall Mall, S.W.1. Nom. cap.: £100. Dirs.: Louis H. Watt and Stanley A. Green.

J. D. Hall Ltd. Manufacturers of and wholesale and retail dealers in and agents for domestic household and general electrical equipment, etc. Nom. cap.: £500. Dirs.: John D. Hall and Mrs Ethel E. Hall, "Pinhay," Yarningale Common, Claverdon, Warwick.

Hesa Electrical Wholesale Co. Ltd., 892a Uxbridge Rd, Hayes, Middx. To take over the business carried on at Haves by S. R. Hansell, etc. Nom. cap.: £5,000. Dirs.: Stanley R. Hansell and Mrs Jamesina M. Weldon.

Home Electrical Products (Midlands) Ltd., 39 Queens Rd, Coventry. Nom. cap.: £100. Dirs.: Arthur T. Bowring, James R. B. Park, Leonard W. Kemp and Walter H. Jones.

Home Electrical Products (Northern) Ltd. Nom. Cap.: £100. Other particulars are similar to Home Electrical Products (Midlands) Ltd.

Home Electrical Products (Southern) Ltd., 39 Queens Rd, Coventry. Letters of and dealers in electrical and domestic appliances, etc. Nom. cap.: £100. Dirs.: Arthur T. Bowring, James R. B. Park, Leonard W. Kemp and Walter H. Jones.

Kerstar Ltd., 16 Sheep St, Northampton. Electrical engineers, etc. Nom. cap.: £1,000. Dirs.: Hugh F. Kerins and Veljko Starcevic.

D. R. Kershaw Ltd., "Villa Neptune," Seaford Park Rd, Hillhead, nr. Fareham, Hants. Electrical contractors, radio and television engineers, etc. Nom. cap.: £100. Dirs.: Delwyn R. Kershaw and Mrs Sylvia I. Kershaw.

G. T. M. Lampkin Ltd., 3 Acorn Rd, Gillingham, Kent. Electrical contractors, engineers, etc. Nom. cap.: £1,000. Dirs.: Geo. T. M. Lampkin and Mrs Alma E. Lampkin.

L.D.P. Consultants Ltd., 52 Bedford Row, W.C.1. Consultants in the installation and application of all forms of cybernetic systems, etc. Nom. cap.: £100. Dirs.: Brian D. Corbett and John K. Melling.

C. S. Martin Holdings Ltd. General, electrical and mechanical engineers, etc. Nom. cap.: £9,500. Dirs. not named. Subs.: Wm. Leask, 56 Wavertree Drive, Leicester; and Margaret E. Tibbles, 217 Glenfield Rd, Leicester.

E. M. McNally Ltd., 159 Lytham Rd, Blackpool. Electrical goods dealers, etc. Nom. cap.: £100. Dirs.: Arthur MacNally and Mrs Eileen M. MacNally.

M. and R. Electrical Services Ltd., The Gables, Station Rd, Ystradgynlais, Swansea. To take over the business carried on by company of same name at Ystradgynlais, Swansea, etc. Nom. cap.: £1,000. Permanent dirs.: Stanley Morgan and Mrs Mary Morgan.

Roston Electrical Ltd., 434 Euston Rd, N.W.1. Nom. cap.: £1,000. Dirs.: Basil B. Stone and Elsie M. Stone.

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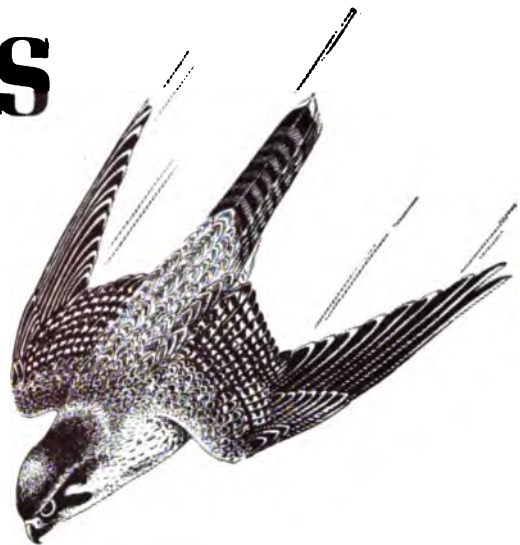
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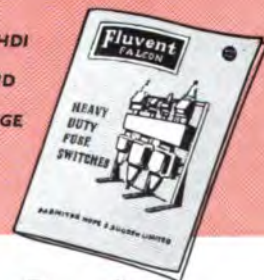
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(How to win friends and influence customers with the nearest thing to daylight—MAZDA °KOLOR-RITE FLUORESCENT LAMPS)

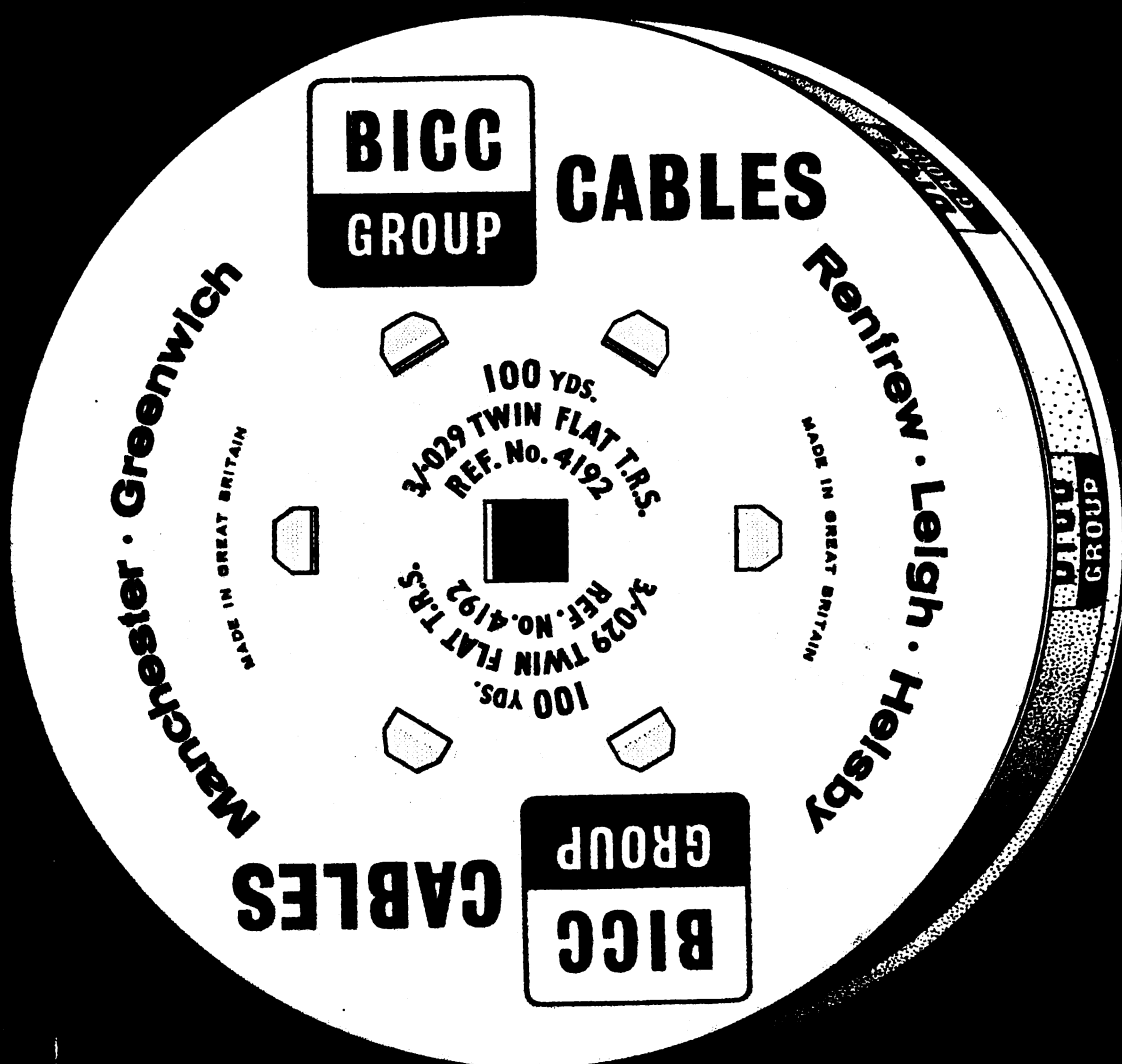
Daylight not only helps skilled workers to do "close work", it also helps to sell what they're making. It sells anything from food to fabrics, from ice-cream to ideas. Only with daylight can you be absolutely sure that what you're displaying has a fighting chance of looking "the real thing".

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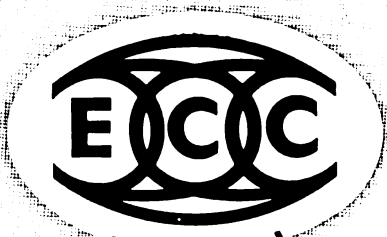
form of the new Mazda °Kolor-rite fluorescent lamps. These lamps really are the nearest thing to daylight. And because they have the effect of bringing outdoors indoors, they enable colours to look fresh and natural. What more could you want to make any presentation vividly attractive? Be sure you're getting Mazda °Kolor-rite fluorescent lamps. *Made in 5 ft. tubes with B.C. and Bi-pin caps. Also in 4 ft. tubes with Bi-pin caps.*



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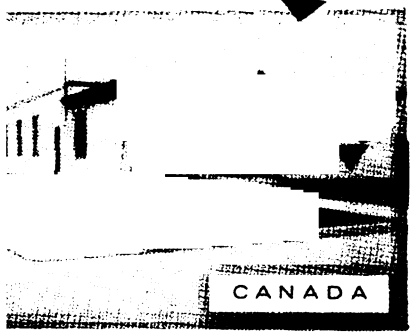
CONTACTOR TYPE CONTROL GEAR

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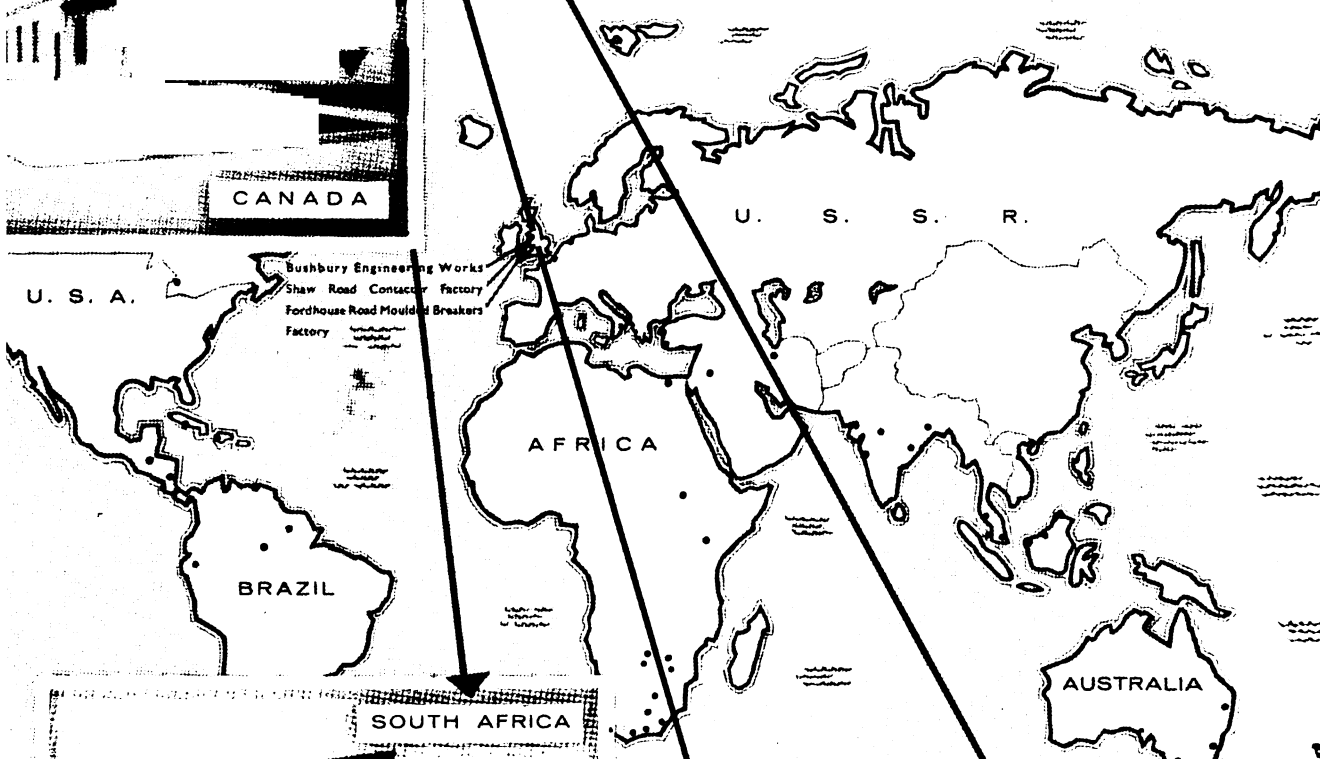
RECTIFIERS

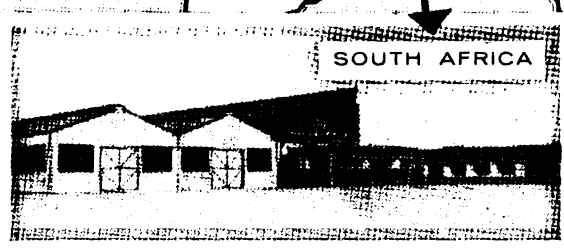
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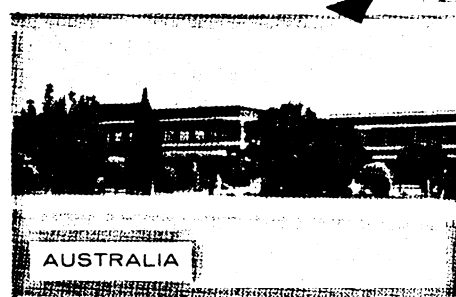




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Dans ce numéro

Protection coordonnée de feeder/transformateur ... 747
La fonction principale des dispositifs de protection des systèmes de distribution d'énergie électrique est de parer aux effets des fautes et localiser les zones troublées. La célérité d'opération est essentielle lorsque des fautes transitoires se révèlent qui, étant dommageables, pourraient devenir autant de fautes persistantes. Dans le cas de réseaux à double lignes entre la source et la faute elle-même, ces deux lignes devront être isolées. Le problème de la coordination des réglages des relais protecteurs, interrupteurs et retards dans le but d'effectuer un fonctionnement judicieux est discuté

Moteur d'induction à vitesse variable ... 753
L'usage d'un enroulement statorique disposé de telle façon que l'espacement physique entre les centres des groupes de phases permet d'obtenir la vitesse variable d'un moteur d'induction, cage écureuil. L'enroulement statorique est alimenté par un transformateur polyphasé incorporant un enroulement à espacement logarithmique. L'interconnexion des deux dispositifs a pour effet de changer le nombre effectif de pôles sur le stator du moteur, soit donc le pas des pôles et, conséquemment, la vitesse. La technique en question a été dénommée "étirage de la pole".

Présentation de Combustible Nucléaire ... 769
Dans les réacteurs d'énergie nucléaire britanniques, l'uranium est contenu dans des bidons d'alliage au magnésium. La forme employée pour les réacteurs de distribution d'énergie consiste soit d'ailettes hélicoïdes à l'extérieur du bidon et d'ailettes longitudinales ("fendeuses") pour disperser le passage des gaz; soit encore des fendeuses hélicoïdes et ailettes longitudinales. La considération de la chaleur mène à ce choix de forme.

In dieser Nummer

Ausgerichteter Speisetransformatorschutz ... 747
In Kraftstromnetze eingebaute Schutzvorrichtungen dienen vor allem dazu, den Auswirkungen von Netzfehlern vorzubeugen und Störbereiche einzugrenzen. Bei vorübergehenden Störungen ist ein schnelles Ansprechen der Schutzvorrichtungen von primärer Bedeutung, damit keine Beschädigungen entstehen, die leicht zu Dauerstörungen führen könnten. Gibt es zwei stromwege zwischen Stromquelle und Fehlerort, so muss für die Trennung beider Leitungen Sorge getroffen werden. Der Artikel befasst sich mit dem Problem der Koordinierung bei der Einstellung von Schutzrelais, Unterbrechern und Verzögerungsvorrichtungen wenn es sich darum handelt, eine selektive Wirkungsweise zu erzielen.

Asynchronmotor mit veränderlicher Drehzahl ... 753
Die Verwendung einer Statorwicklung, die so angeordnet ist, dass die räumliche Entfernung zwischen Phasengruppenmittelpunkten veränderlich ist macht es möglich, einen Asynchronmotor mit Kurzschlussläufer als Regelmotor zu betreiben. Hierzu wird die Statorwicklung von einem phasenvervielfältigenden Transformator gespeist, eine Wicklung mit logarithmischer Teilung aufweist. Durch Verbinden dieser beiden Vorrichtungen untereinander lässt sich die wirksame Polzahl des Motorständers und damit dessen Polteilung und folglich die Drehzahl des Motors ändern. Für dieses Konstruktionsprinzip ist die Bezeichnung "Poldehnung" geprägt worden.

Ausführungsform nuklearen Brennstoffs ... 769
Das in britischen nuklearen Kraftwerken verwendete Uran wird in Behältern aus Magnesiumlegierung geliefert. Die für die Reaktoren von nuklearen Stromerzeugungsanlagen verwendete Ausführungsform dieser Behälter weist entweder schraubenförmige äussere Rippen und längs-angeordnete Rippen ("Aufspalter") oder umgekehrt schraubenförmige Aufspalter und Längsrippen zur Zerteilung des Gasstromes auf. Diese Formgebung beruht auf Wärmedurchgangserwägungen.

ELECTRICAL
TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
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Co-ordination of Feeder and Transformer Protection 747
by A. Salzmann, DIPL.ING., A.M.I.E.E.
Variable Speed Induction Motors ... 753
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Gravesend's biggest—for Leicester



The largest oil-filled cable ever to be made at AEI's Gravesend Works is this 132 kV 3-core giant, laid under the busy streets of Leicester. 8,000 yards of this cable was installed by the AEI Construction (Cables and Lines) Division for the East Midlands Electricity Board, to reinforce the supply to the northern area of the city.

Some vital statistics: 0.60 sq. in. compacted circular copper conductors; aluminium oil ducts; lead sheathed with tin bronze reinforcement and protected with anti-corrosion serving; overall diameter 4.85 in. Supplied on 11 ft. diameter drums weighing 12 tons each.



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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 17 NOVEMBER, 1960

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T. W. WRIGHT

Comment

SHORT-CIRCUIT IN TRADE

Net price trading direct to large users is on the increase in the electrical industry; it is becoming so prevalent that last week a public protest against it was made by a well-known contractor. The names of the manufacturers and wholesalers indulging in this form of short-circuiting of contractors are commonly known, though spoken only with bated breath. It is in the lighting field that the practice has principally, though not wholly, developed; and here at least there may be some sympathy for the manufacturers' viewpoint. They maintain lighting design departments and often deal direct with large users in the planning of installations. It may seem a natural corollary to them to extend this to direct trading on net terms. On the other hand, the electrical contractor has a firm stake in the installation, not only in the fixing and connection of fittings, but in his overall responsibility for the installation, a stake that was recognised in the former discount structure. Discounts have to be earned, not merely acquired, and if pricing policy of contractors reflected this more patently it would be less easy for net price selling to extend. The real difficulty arises from the uncertainty of the discount situation at the time of tendering. There seems little doubt that the orderly trading conditions of the past will be under continuous attack in the future. The temptation to secure an initial trading advantage will always be there, without thought to the eventual outcome to which such practices may lead. Fortunately, there are still many in the industry who favour more orderly trading. Some discussions have already taken place between associations on this particular problem of net price selling, but inevitably the RTP Act hangs heavily over all such proceedings. Yet some solution must be found, even though it be no more than strong self-discipline, if trading conditions are not to deteriorate to the level they have in some other countries. It is just such cases as that discussed here that are in the minds of those who urge the retention of some form of fair trading forum.

GAS TURBINE TACTICS

Announcement that the CEGB is to spend £200,000 on an experimental 15 MW gas-turbine plant for installation at Hams Hall raises questions about the best way to use such low capital cost units in electricity supply. Installation of this particular unit at a power station has presumably been decided on as a convenient arrangement for a prototype whose abilities are still to be investigated. (Provision of a 20 MW-rated alternator may be significant.) The quick-starting characteristic of gas-turbine generators and their suitability for remote control without continual

attendance, demonstrated in this country in the 3 MW SWEB installations, otherwise call for installation nearer load centres, where transmission losses are minimised and standby value—so far as consumers are concerned, at least—is at a maximum. If the trials prove successful, 15 MW at just over £13/kW in capital cost for the complete set is going to be a weapon worth thinking about in the fight with the peak demand. Relevant figures in financial terms include peak kW on the bulk supply tariff chargeable at £7 2s, and interruptible supply allowance of £3 19s/kW. Taken in conjunction with standby advantages, that sort of cost is likely to make area boards think hard about their generating rights under the 1957 Electricity Act, and the larger industrial undertakings wonder about their own peak-logging possibilities.

COMMERCIAL FREEDOM IN SUPPLY

Last week's House of Commons debate on investment in nationalised industries brought out the usual rash of MPs who are concerned at the high level of investment demanded by electricity supply. Many of them made speeches showing clearly that they had not studied their subject before offering the Government the benefit of their advice; but amongst the more thoughtful contributions to the debate there recurred a theme which needs countering by the supply industry. It is the argument that MP's should consider in some detail the annual investment programmes of each nationalised industry, every year, immediately after they are approved by the Government. This is additional to the study of the industries, one by one, by the Select Committee on Nationalised Industries, which now seems to have established itself, after an uncertain beginning, as an effective element of the House of Commons machinery. The full Select Committee inquiry will come round to each board about once every seven years, providing the overall outside evaluation which Lord Morrison of Lambeth used to advocate for public corporations in the early days of political thinking on the question. The new idea would involve far more interference and would inevitably delay still further already long-drawn-out decision processes which control spending. There will no doubt be another airing of the new scheme when a White Paper is published in the spring to give details of each nationalised industry's self-financing target for the next financial year; and the Chancellor of the Exchequer has pronounced himself as having an open mind about it. The supply industry's leaders should lose no time in urging the undesirability of such extra inquiries from the operating aspect; and, indeed, their justifiable irritation at the number of "investigations" to which they are subject.

REGULAR WIRING INSPECTION

Members of the National Inspection Council for Electrical Installation Contracting gathered for their annual meeting last week in the satisfactory

knowledge that the number of enrolled contractors is increasing at an accelerating rate. In the current financial year, applications for membership are well ahead of those previously recorded. Rate of progress is geographically patchy, for contractors are frequently persuaded to join because of the decision of local authorities and others controlling large volumes of business to use only approved electrical contractors on their work. In consequence, the decision by a particular county council or the like brings a flood of inquiries from the area concerned. This means a rush of work for the local NIC inspecting engineer, for two full inspections (each of three jobs) is the rule rather than the exception before a small firm is admitted to the NIC roll. Such work inevitably interferes with the routine inspections which should provide a yearly check on how contractors are keeping up their standards. In some areas the result has been an inspection interval nearer 18 months than 12. To bring it back to 12 months might need two more inspecting engineers additional to the one recently appointed. Further, the need for flexibility to meet the uneven incidence of new applications suggests that such extra staff would be more effective if deployed with some second layer of control between headquarters and districts. Perhaps the appointment of senior engineers to control the work load in the north and the south of the country is worth considering. Money is a difficulty, of course. Fees do not cover the cost of NIC activities, the general body of electricity consumers pay, through area boards, contributions representing a little more than ½d/head. But a slight increase on that spending seems justified if the overall results of the NIC are agreed to be worth while.

THE CONVENIENCE OF ELECTRICITY

Electric floor-warming has found some strange bed-fellows. From flats to factories, and houses to hospitals, the unseen installations are quietly giving the off-peak load the industry deserves. The South of Scotland Board, which has done so much pioneering in this field, has been looking for new worlds to conquer. It has found one; it is a public convenience at Stirling. Not an ordinary convenience, but one worthy of a Welfare State. The architecture is modern in style, so excellent as perhaps to raise doubts as to the purpose of the building in the mind of an urgent client. Inside, all is electric. Not only is there the automatic floor-warming installation in the Ladies, in the Gents and in a common meeting place, the left-luggage office, but there are ample supplies of electrically heated water also; while for those who pass the class distinction of a coin-operated turnstile, sockets are available for electric shavers. The décor is of the best. This new public asset is centrally situated, significantly, perhaps, near the town hall, a scheduled ancient monument. Like Clochemerle, Stirling has every reason to be proud of its new progress.

Meteor

Co-ordination of feeder and transformer protection

by A. Salzmann, Dipl.Ing., A.M.I.E.E.

PROTECTIVE devices for power systems should be regarded as an insurance against the cost of damage to equipment and interruption of supply. Their main task is, therefore, to protect the system from faults and the effects of faults on the remainder of the network. In the event of a transient fault, the protective relay should operate rapidly and before serious damage occurs, otherwise the fault might develop into a persistent one. Faster operating protective gear will prevent transient faults from becoming persistent. However, on the occurrence of persistent faults—namely, faults which persist regardless of speed of operation of relays and circuit-breakers—the task of the latter is to isolate the faulty line section leaving healthy circuits unaffected by fault-plus-load currents.

In power systems with one path between fault and source of supply (radial networks) the circuit-breaker nearest to the fault should open first. In networks with multiple paths between source and fault, i.e., ring mains (a substation has two in-feeds), both circuit-breakers of the faulty section should operate while those of the healthy circuits should remain stable. This also applies to power systems with multiple paths between source and fault; that interconnected networks having complex interconnections forming a number of meshes.

From the above introductory notes it follows that protective requirements are met if the relays (a) disconnect faulty feeders with the minimum of delay and damage to transmission elements and (b) stability to the remainder of the power system is ensured. Discriminative fault clearance and stability are, therefore, of primary importance. Discrimination secures disconnection of the faulty feeder only, while stability means that healthy line sections remain unaffected by the fault current passing through them. Since discrimination and stability are interrelated, it is essential that improvement of discrimination should not be at the expense of stability and vice versa.

These requirements will be satisfied by employing high speed protective gear, namely relays and circuit-breakers, and by co-ordinating the relay settings of various transmission and distribution elements.

In dealing with the problem of co-ordinating relay settings for medium voltage systems, it is in accordance with

modern practice to utilise (a) high speed switched distance protection with stepped time-distance characteristics for transmission lines, (b) induction type time graded overcurrent relays for substation transformers located on the high voltage side or inverse time overcurrent relays located on the low voltage side supplemented by high set instantaneous overcurrent relays placed on the h.v. side, (c) overall biased differential protection for large size transformers and (d) time graded overcurrent relays for distribution networks.

It should, however, be emphasised that difficulties may arise in clearing faults discriminately when different protection methods, such as overcurrent and impedance protection, are applied. Speedy operation of relays nearer to the source of supply (second zone of the impedance relay) cannot be reconciled with the requirement of delayed operation necessary to secure selective operation with transformer overcurrent protection. Discriminative fault clearance can be achieved only at the expense of delayed operation of the impedance relay in its second zone, should the overcurrent relay fail to operate.

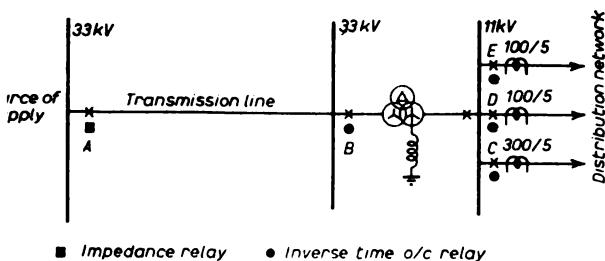
Regarding earth fault protection of transmission lines, no co-ordinating problem exists when switched impedance protection is employed. Using a single impedance relay to cope with phase-to-phase and line-to-earth faults, it must provide the same ohmic setting for both types of fault. Co-ordinating of feeder and transformer relaying will also not be required because the zero sequence networks on either side of the transformers are isolated from one another, hence the settings of the relays on the h.v. side are independent of those on the l.v. side. This applies particularly to delta-star or star-tertiary-star connected transformers, the star point of the latter being isolated on the high voltage side.

For example, the impedance relay acting as back-up relay may not respond correctly in the event of a line-to-earth fault on the l.v. side, because the starting relay of the overcurrent type will select wrong voltages. For a delta-star connected unit with ratio $1:\sqrt{3}$, l.v. current distribution 1:0:0 will yield a current distribution 1:0:1 on the h.v. side. Similarly, for a star-tertiary-star connected transformer with transformation ratio 1:1, l.v. current distribution 1:0:0 will cause a distribution $\frac{1}{3}:\frac{1}{3}:\frac{1}{3}$ on the h.v. side.

If arc suppression coils are in use on either side of the transformer, co-ordination of relaying is not required unless earth fault protection is provided for persistent faults only. In this case, grading of the relays is carried out independently on either side.

Radial Networks

For these circuits we apply high-speed impedance protection to transmission feeders, while transformers and distribution circuits are provided with inverse time overcurrent relays of the induction type (Fig. 1). Here the fault current magnitude on the lower voltage side is practically independent of change in generation and the



1. Single line diagram of tail-end feeder protected by impedance and overcurrent relays

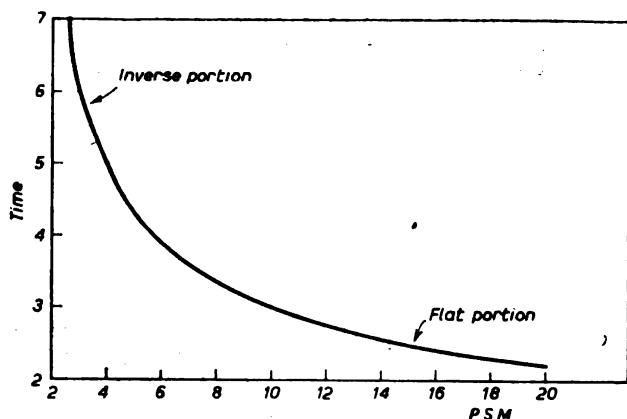


Fig. 2. Graph showing the time-current characteristic of the inverse time-overcurrent relay. Time setting multiplier (TSM)=1.0

inverse portion of the relay time-current characteristic (Fig. 2) is used with advantage to secure discriminative operation between distribution and transformer overcurrent protection. For transmission lines (medium voltage networks) the impedance relay in use is a single-phase unit coping with various type of faults. The maximum distance/impedance to which the relay responds is called the reach of the relay and the latter operates for values below that for which it is set. For transformer feeders, high-speed protection is provided for the total length of the line section as the transformer can be considered as part of the line with both impedances taken together. Transformer faults, on the other hand, are "seen" by the impedance relay in its second zone, acting as back-up relay in the case overcurrent protection fails to operate. Second zone operating time is equal to the time required for the overcurrent relay plus a time allowance, taking into account various errors of the protective devices and tripping time of the circuit-breaker.

In this manner, selective operation based on reach and time between impedance and transformer overcurrent protection can be achieved.

The procedure of co-ordinating the relay settings is as follows:

The first step is to determine the setting of the overcurrent relay for the distribution feeder with the largest current transformer ratio (relay C in Fig. 1).¹ We select the current setting for a given load requirement while the time setting is adjusted to its minimum value. The current setting ranges from 50% to 200% (seven steps) while the time setting is from 0 to 1.0 second in steps of 0.05 second.

With the aid of the standard time-current characteristic (Fig. 2) the relay operating time is determined at maximum time setting (TSM=1.0) for any fault current.² The latter can be expressed in terms of multiples of the relay plug setting, one curve being utilised for seven current settings.

The plug setting multiplier (PSM) is given by:

$$PSM = \frac{100F}{R.N.S.} \dots (1)$$

where F=fault current in amps
R=C.T. ratio
N=relay nominal current
S=percentage relay plug setting.

The CT ratio, fault current and plug setting are, therefore, required to determine the operating time t at a time setting multiplier TSM=1.0 from the relay characteristic.

Any other time setting TSM_x will give an operating time t_x proportional to t_x TSM_x.

Assuming relay C to have a time setting TSM₀ and current setting C%, discriminative fault clearance is ensured if the transformer overcurrent relay, B, is set to operate selectively with relay C. Taking into account relay inaccuracy, overswing, current transformer errors and circuit-breaker tripping time t_{pb} , a discriminative time interval between the consecutive relays, B and C, should not be less than t_b plus twice the tripping time t_{pc} of the circuit-breaker C. With the aid of equation 1, the graph (Fig. 2), a given load requirement, current setting and minimum time setting TSM, we can determine the operating time t_b for a three-phase fault close to relay C, the fault location, "F," and minimum short-circuit level at the source of supply.

Thus, the optimum operating time, t_b , of relay B is equal to $(t_b + 2t_{pb})$ sec, which enables us to determine the time setting TSM_B. Selecting a current setting B% for the transformer, we get PSM_B from equation 1 and, consequently, the operating time t_{B0} from the graph (Fig. 2). The time setting ensuring discriminative fault clearance is, therefore, TSM_B= t_b/t_{B0} .

As a further step, we now consider the setting of the impedance relay, A. High-speed protection is applied to the first zone while the second and third zones are set to "see" faults on the transformer and l.v. distribution feeders, and the operating times are to be related to transformer overcurrent protection. Time, t_b , of relay B and tripping time t_{pb} of the circuit-breaker determine $t_{A2}=(t_b + 2t_{pb})$ the operating time of relay A in the second zone.

It should be emphasised that the time-distance characteristics of the inverse time overcurrent relays, B and C, are almost linear (graph B and C, Fig. 3) because of the relationship $t=K/I_f$ and $I_f=K_1/D$. In these equations t =time of operation; I_f =fault current; K and K_1 =constants and D =distance between relaying point and fault. It follows that the relay operating time is about proportional to the impedance of the transformers and distribution feeders, hence the almost linear characteristic. In Fig. 3 it is shown that the second zone reach (relay A) has to be terminated before graphs A and C intersect to prevent maloperation in the event of a fault at the remote end of the distribution feeder.

As a further illustration, let us consider a practical example (see Fig. 4). A 10 MVA transformer, ratio 33/11 kV, impedance 10%, is fed from one source of supply having a fault capacity 700 MVA. System constant settings of relay B, symmetrical three-phase short

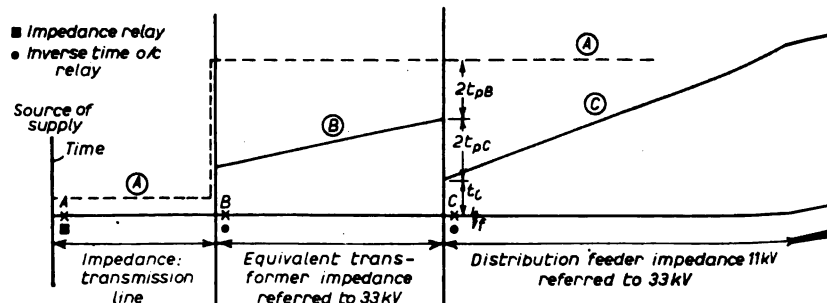


Fig. 3. Time distance characteristic of impedance and inverse time overcurrent relays for circuit shown in Fig. 1. A=characteristic for impedance relay. B=characteristic for transformer o/c relay. C=characteristic for feeder o/c relay

level and impedances corresponding to the megawatt per ampere based on 10 MVA and 33 kV and expressed as shown on the diagram. With aid of equation 1 graph, Fig. 2, calculated fault currents, time and settings of relay B, we can determine the operating time, namely, $t_{B1}=0.75$ sec; $t_{B2}=0.93$ sec; $t_{B3}=1.05$ sec; 1 sec; and $t_{B4}=1.32$ sec, showing that the time characteristic of the inverse time overcurrent relay is linear.

Alternative solution of the co-ordinating problem is speed transformer protection utilising overcurrent relay placed on the l.v. side. Here the instantaneous zone impedance relay "sees" faults within, say, 90% in Fig. 5. The second, and in some cases the one are set to "see" faults on the distribution and act as a back-up relay for the busbars and feeder faults.

In this manner, most of the transformer faults are at high speed. However, in the event of an internal fault in the diverter compartment of the tap changer used—the fault cannot be removed by the Buchholz relay—it will be cleared by a circuit-breaker remote from the transformer. In some cases, high-set instantaneous overcurrent relay located on the h.v. side should be considered as a

way, a few notes on interconnection of power transmission. For star-tertiary-star connected units, back-up on the first line of defence present no difficulties. The relay will respond correctly to phase-to-phase faults on the lower voltage side since the current distribution on the h.v. side—namely, 1:1:0; 0:1:1; 1:0:1—is identical on the l.v. side, assuming 1:1 transformation ratio. Delta-star connected transformers phase-to-phase faults on the l.v. side, say red to yellow current distribution 1:0:0, will yield on the h.v. side current distribution 1:0:0 or a transformation ratio $1:\sqrt{3}$, consequently the time starting relays of the overcurrent type will give wrong voltages, causing doubtful operation. The impedance relay will operate correctly if only the h.v. side is involved. Finally, the use of under-impedance relays should be considered as an alternative.

Mains and Mesh Connected Networks

In these networks, difficulties may arise in clearing faults indiscriminately when different protection methods are applied. As an illustration let us consider the network in Fig. 6. The application of the graphical method for determining relay settings, illustrated in Fig. 7, will be useful as reach and time delay can be adjusted

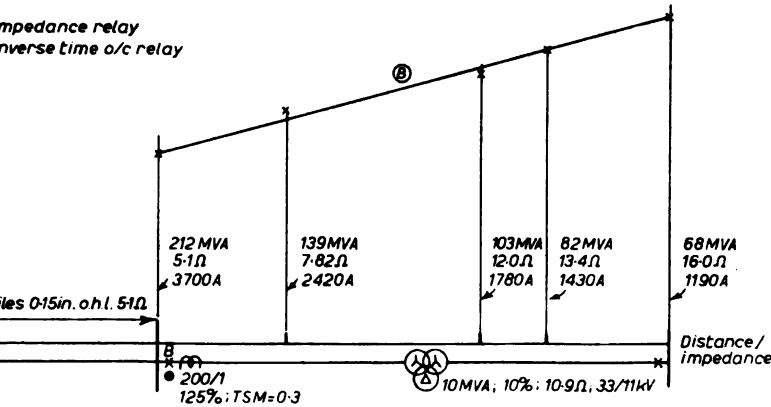


Fig. 4. Time distance characteristic of an inverse time-overcurrent relay

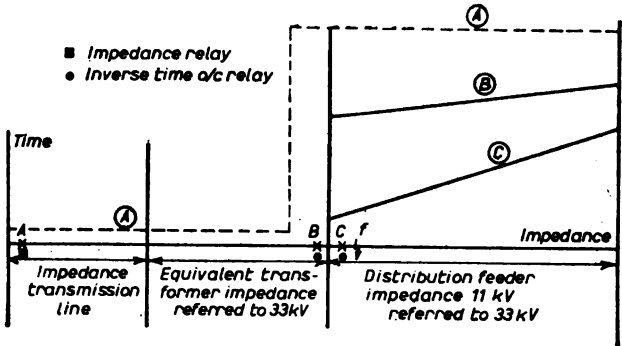


Fig. 5. Time distance characteristic of impedance and inverse time overcurrent relay for circuit shown in Fig. 1. The o/c relay is placed on the l.v. side

independently. We note that the curves above the base-line represents the characteristics of the relays a, c, e and g for power flow in the direction from a to b and those below the base-line the characteristics for the relays h, f, d and b for power flow in the direction from h to g.

Grading of the impedance relay, first zone, is straight forward. Each relay rapidly measures the distance to the fault occurring within 80% of any line section.

Grading of the second and third zones has to take into account the corresponding zones of the relay protecting adjoining sections. The second zone, say, relay h, should be selective with the second zone of relay f based on reach. It should terminate 20% behind the instantaneous zone of relay f taking origin A as reference point and assuming that 80% of each line section is provided with high-speed protection.

Similarly, the balance point of the third zone reach relay h is 20% behind the second zone of relay f, again taking point A as reference. For example, the ohmic setting of relay h, second zone, based on reach is obtained by adding to the impedance $Z_{f1}=0.8Z_{L1}$ of the first zone relay f, the impedance of the total length of section L₁, namely Z_{L1} , and taking 80% of this value. Thus, we get $Z_{h2}=(Z_{L1}+0.8Z_{L1})0.8$. However, although relay h in the second zone has to function selectively with the second zone of the neighbouring relay f, based on reach, this relay has to operate discriminately as regards time related to transformer overcurrent protection for unit T_a. This applies to the third zone as well in case the second zone reach does not extend to transformer faults.

In fact, transformers should be considered as feeders. For a fault, f_{L1}, the directional impedance relays g and f remain inoperative and the fault appears to the relay, h, as being further away than it actually is.

The voltage applied to relay h (assuming a high short-circuit level at the source of supply) is equal to $V_h=I_hZ_{L1}+(I_h+I_a)Z_a$ and the impedance appears to the relay as:

$$V_h/I_h=Z_{L1}+(I_1/I_h)Z_a.....(2)$$

The latter, therefore, measures an impedance larger than the true impedance ($Z_{L1}+Z_a$), since current I_h is smaller than the total fault current I_1 .

It follows that the relay under-reaches as the fault appears further away than it actually is and the second zone reach must be adjusted to act as a back-up relay in the event of transformer overcurrent protection failing to operate, or, alternatively,

the relay will protect a smaller portion of the transformer.

The third zone ohmic setting is also based on time and reach, which should be related to the longest adjacent line section.

As a further illustration of co-ordinating feeder and transformer relaying, let us consider relay *a*. It is obvious that the second zone of the latter must be related to the operating time of the transformer overcurrent relay *i*. The time setting for relay *i* is determined in the manner already outlined. The optimum time setting TSM_i is obtained with maximum short-circuit level at the source of supply for a three-phase short-circuit, namely, close-up fault *f*₁ on the distribution feeder *l*₁ and only one transformer in circuit (Fig. 6). A fault, *f*_{1a}, occurring on transformer *T*_b, and assuming minimum short-circuit level at the source of supply corresponding to an impedance equal to the second zone reach of relay *a* will cause overcurrent relay *i* to operate *t*₁₀ secs as determined from the graph in Fig. 2. Thus, the optimum operating time of relay *i* is equal to *t*₁=*t*₁₀. TSM_i and the second zone operating time of the impedance relay *a* should not be less than *t*_{a2}=(*t*₁+2 *t*_{pa}) where *t*_{pa} represents the tripping time of the circuit-breaker *a*. Ignoring the underreaching effect, the ohmic setting of the second zone is, therefore, *Z*_{a2}=*Z*_{L1}+*Z*_b.

However, when taking into account underreaching tendency, the point of balance (second zone reach) must be nearer to the busbars *B* for a fault on the transformer than for a fault on line section *L*₂. This follows from the second equation above. Thus, a fault, *f*_{1a}, on unit *T*_b may not be "seen" by the impedance relay *a* in its second zone. The latter remains idle if relay *i* fails to operate while the corresponding fault *f*_{1a}' on line section *L*₂ will be "seen" by the relay in its second zone. Thus, with settings *Z*_{a2}(ohms), relay *a* protects a smaller portion of the transformer equivalent to (*Z*_{a2}-*Z*_{L1})/(*I*₁'/*I*_a')ohms where *I*₁' and *I*_a' are fault currents corresponding to the nearest fault (location *f*_{1a}') on unit *T*_b. Relay *a* will measure the impedance according to the equation (2).
$$Z_{a2} = Z_{L1} + [Z_b / (I_1' / I_a')] I_1 / I_a \text{ ohms}$$
since ratios *I*₁'/*I*_a' and *I*₁/*I*_a are approximately identical (see example).

Table 1. System Constants

Line Transformer Feeder	Relay	Type of Relay	Line length, Transformer, Feeder data	(a) Imped. Ohms	(b) Imped. %	(c) Imped. Ohms	C.T. Ratio	P.T. Ratio	Transformation Ratio 400/5 . 110/33000
L ₁	a.b.	Imped	10 ml. 0·15"	5·6	5·15	1·48	400/5	33000/110	0·266
L ₂	c.d.	Imped	12 ml. 0·15"	7·5	6·90	2·00	400/5	33000/110	0·266
L ₃	e.f.	Imped	4 ml. 0·15"	2·5	2·30	0·62	400/5	33000/110	0·266
L ₄	g.h.	Imped	4 ml. 0·15"	2·5	2·30	0·62	400/5	33000/110	0·266
T _a	k	o/c	10MVA, 10%	10·9	10·00	2·90	200/1	—	—
T _b	i	o/c	5MVA, 8%	17·4	16·00	4·62	100/1	—	—
T _c	i	o/c	5MVA, 8%	17·4	16·00	4·62	100/1	—	—
l ₁	j	o/c	6 ml. 0·10"	38·7	35·30	10·4	300/5	—	—
l ₂	i	o/c	7 ml. 0·10"	45·55	42·00	12·4	300/5	—	—

(a) Referred to 33 kV.
(c) "Seen" by impedance relays.

(b) Referred to 10 MVA base and 33 kV.

However, if the length of the line section is short, it is possible that the impedance relay might not "see" a transformer fault at all in its second zone.

Regarding third zone setting *Z*_{a3}, the reach should be terminated as outlined earlier, that is, 20% behind the second zone relay *c*, taking point *A* as reference. However, since the operating time of relay *e* in its second zone has to be related to the time *t*_k of overcurrent relay *k*, the operating times *t*_{a3}, *t*_{a2} and *t*_{a1} have to be increased accordingly, as shown in Fig. 7, and adjustment of third zone setting, *Z*_{a3}, in regard to time and reach are made without jeopardising the discriminative fault clearance.

It should be noted from Fig. 7 that the ohmic settings for relays *a*, *c*, *h* and *f* have their limitation by reason of the requirement of discriminative relay operation based on reach. In some cases it is unlikely that these relays will "see" transformer faults particularly for short line sections and if underreach is to be taken into account. In this case, third zone protection will clear transformer faults but at the expense of delayed operation should the transformer overcurrent relay fail to operate.

Relays *d* and *e* in the second and third zone reaches are not limited because co-ordination of ohmic settings related to adjacent line sections is not required. These relays are permitted to "see" faults up to the remote end of distribution feeders in their second, and possibly in their third zones, provided their operating times exceed *t*₁ and *t*₂ for faults at the remote end of the 11 kV feeders with minimum short-circuit level at the source of supply. The

impedances of this feeder appears to the relay as nine times its actual value [(33/11)²]. If the relays are set to "see" faults at the remote end of the distribution feeder, selective operation between impedance and distribution overcurrent protection, based on time, must be ensured.

Finally, an alternative solution is to place the transformer overcurrent relay on the l.v. side with the object (a) of using impedance protection as first line defence for certain type of faults, (b) shorten the fault clearance time and (c) using the third zone as back-up protection as shown in Fig. 8. However, for ring mains consisting of short line sections, the impedance relay is not likely to "see" transformer faults in its second zone,

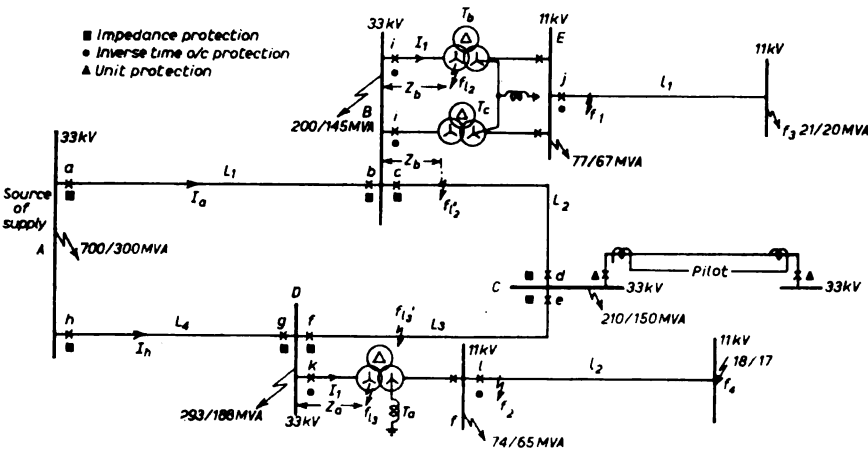


Fig. 6. Single line diagram of a 3 kV ring main system incorporating impedance protection

Table 2. Relay Settings

Ref	Relay	(a) Line section impedances ohms/cond. ref. 33 kV (2)	(c) Impedance, ohms, "seen" by the impe- dence relays (3)	Secy. imped. of zones			Tripping time of zones			Overcurrent relay settings	
				Z ₁ ohms (4)	Z ₂ ohms (5)	Z ₃ ohms (6)	t ₁ secs (7)	t ₂ secs (8)	t ₃ secs (9)	time (10)	current (11)
1	a	5.60	1.48	1.19	2.48	3.08	0.10	1.18	2.90	—	—
2	b	5.60	1.48	1.48	1.48	1.48	0.10	0.10	0.10	—	—
3	c	7.50	2.00	1.60	2.01	3.30	0.10	0.60	2.40	—	—
4	d	7.50	2.00	1.60	20.6	20.6	0.10	1.24	1.24	—	—
5	e	2.50	0.62	0.50	15.7	15.7	0.10	1.90	1.90	—	—
6	f	2.50	0.62	0.50	1.78	3.28	0.10	0.60	1.74	—	—
7	g	2.50	0.62	0.62	0.62	0.62	0.10	0.10	0.10	—	—
8	h	2.50	0.62	0.50	0.89	1.92	0.10	0.60	1.57	—	—
9	i	17.40*	4.62	—	—	—	—	—	—	0.20	125
10	j	38.70	10.40	—	—	—	—	—	—	0.10	50
11	k	10.90	2.90	—	—	—	—	—	—	0.314	125
12	l	45.55	12.40	—	—	—	—	—	—	0.10	50

Key. 2/10/10 = Table 2, Line 10, Col. 10.

* Transformer impedance

the unit being removed from the network, after a time delay, by third zone protection. High-set instantaneous overcurrent relays placed on the h.v. side may be regarded as remedy.

A Practical Example

Let us consider the 33 kV ring main shown in Fig. 6, having one in-feed and supplying substations B, C and D. The outgoing feeder from substation C is provided with unit protection, substation B supplies two transformers, T_b and T_c, each rated at 5 MVA and operating in parallel, and station D supplies one unit, T_d, rated at 10 MVA. These star-tertiary-star connected units are provided with overcurrent protection. Other protective devices are incorporated in the circuit, such as Buchholz, winding temperature and tertiary overcurrent relays, acting as stand-by earth fault protection for distribution feeders.

Switched impedance protection is utilised for the 33 kV ring main and operation is initiated by starting relays of the overcurrent type. System constants are given in Table 1, while symmetrical three-phase short-circuit levels maximum and minimum values are shown in Fig. 6.

It is required to co-ordinate transmission and transformer relaying for (a) *Transformer overcurrent relays placed on the primary side* and (b) *Transformer overcurrent relays placed on the lower voltage side*.

The first step is to co-ordinate distribution and transformer overcurrent protection. For a given load requirement we select current settings while the time settings for relays j and l are adjusted to the minimum values. (See Table 2, 10/10; 10/11; 12/10; 12/11.) Relay i placed on the h.v. side must be set to discriminate with j and l with k, the latter being placed as well on the h.v. side. Selecting for relay i a current setting of 125%, we can determine the optimum time setting, TSM_i, as outlined earlier with maximum short-circuit level at A, one unit, T_a, removed from circuit and a close-up fault at f₁. Similarly, TSM_k is determined for a close-up fault at f₂ (see 9/10; 9/11; 11/10; 11/11). These values will yield operating times t_i=0.74 sec and t_k=0.72 sec.

The second step is to co-ordinate transmission line and transformer overcurrent protection. Starting with relay b in anti-clockwise direction the settings are as follows:

Relay b: Total line section is protected at high speed;

$t_{b1}=0.1 \text{ sec};$
 $Z_{b1}=Z_{L1}=1.48 \text{ ohms (2/4; 2/7);}$
 $t_{b2}=t_{b3}=0.1 \text{ sec};$
 $Z_{b2}=Z_{b3}=1.48 \text{ ohms (2/8; 2/9; 2/5; 2/6).}$

Relay d: First zone:

$t_{d1}=0.1 \text{ sec};$
 $Z_{d1}=0.8Z_{L3}=1.6 \text{ ohms (4/4; 4/7).}$

Second and third zones: The relay is set to "see" faults on units T_b, T_c and distribution feeder 1. Ohmic setting:

$Z_{d2}=Z_{d3}$
 $=[Z_{L3}+17.4/2+Z_{L1} (33/11)^2]$
 0.266
 $=20.6 \text{ ohms (4/5; 4/6).}$

Operating time:

$t_{d3}=t_{d2}.$

The second zone is set to discriminate with transformer overcurrent protection, hence:

$t_{d2}=t_{d3}$
 $=t_1+2xt_{p4}$
 $=0.74+0.5$
 $=1.24 \text{ sec (4/8; 4/9).}$

It will be noted that the reach of the impedance relay is extended into the distribution network. In this case, the operating time of relay j (2₁ secs) for a fault f₂ with minimum short-circuit level at the generating station must be considerably lower than t_{d2}.

Relay f: First zone:

$t_{f1}=0.1 \text{ sec};$
 $Z_{f1}=0.8Z_{L3}$
 $=0.5 \text{ ohms (6/4; 6/7).}$

Second zone:

$Z_{f2}=(0.8Z_{L3}+Z_{L3})0.8$
 $=1.78 \text{ ohms};$

$t_{f2}=0.1+2t_{pf}$
 $=0.6 \text{ sec (6/5; 6/8).}$

Third zone:

$Z_{f3}=(Z_{L1}+Z_{L3}+Z_{L3}) 0.8$
 $=3.28 \text{ ohms};$
 $t_{f3}=t_{d2}+2t_{pf}$
 $=1.74 \text{ sec (6/6; 6/9).}$

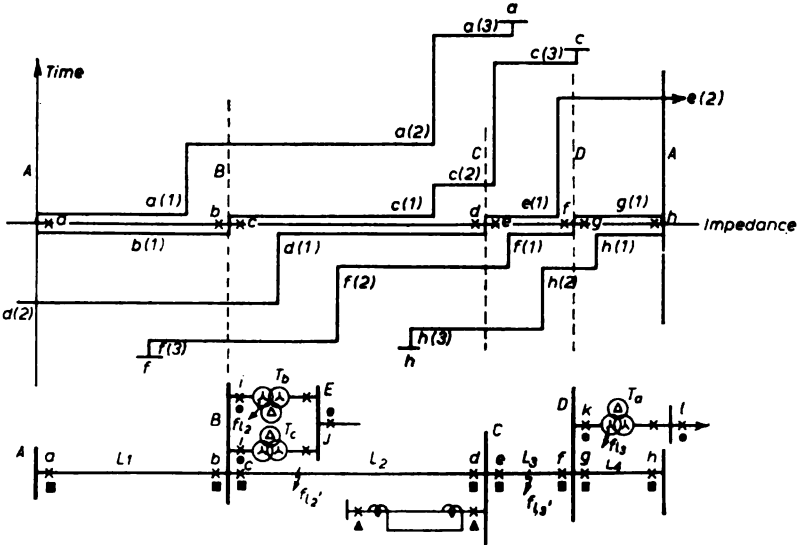


Fig. 7. Grading of inverse time o/c and impedance relays used for the network shown in Fig. 6. The o/c relay is placed on the high voltage side

Relay h: First zone:

$$t_{h1}=0.1 \text{ sec};$$

$$Z_{h1}=0.8Z_{L4}$$

$$=0.5 \text{ ohms } (8/4; 8/7).$$

Second zone: ohmic setting:

$$Z_{h2}=(0.8Z_{L3}+Z_{L4}) 0.8$$

$$=0.89 \text{ ohms referred to 33 kV side}$$

$$Z_{h2}=0.89/0.266$$

$$=3.37 \text{ ohms where } 0.266 \text{ is the transformation ratio CT/PT}=(400/5) (110/33,000).$$

It follows an impedance larger than $(3.37 - Z_{L4})=0.87$ ohms will not be "seen" by the relay *h* and, if the underreach effect is taken into account, the impedance relay remains idle in its second zone for transformer faults. It is, therefore, not required to relate the operating time t_{h2} to overcurrent protection.

Operating time:

$$t_{h2}=0.1+2t_{ph}$$

$$=0.6 \text{ sec } (8/8).$$

Third zone:

$$Z_{h3}=[(0.8Z_{L3}+Z_{L4}) 0.8+Z_{L4}] \times 0.8$$

$$=1.92 \text{ ohms } (8/6) \text{ referred to 33 kV side.}$$

$$Z_{h3}=1.92/0.266$$

$$=7.2 \text{ ohms and the relay will "see" a transformer fault (location } F_{L3}) \text{ corresponding to } (7.2 - Z_{L4})$$

$$=4.7 \text{ ohms referred to the secondary side}$$

$$4.7 \times 0.266$$

$$=1.25 \text{ ohms or } 4.32\% \text{ based on 10 MVA.}$$

Operating time t_{h3} is related to overcurrent relay *k* for a fault at f_{L3} and minimum short-circuit level at A we obtain fault currents $I_b=1560\text{A}$; $I_1=1810\text{A}$ and $I_1/I_b=1.16$. Accordingly we get $PSM_k=[1810/200/1]/(100/125)=7.3$ giving the operating time for relay *k* from Fig. 2 as 3.4 sec. Hence the actual operating time $t_k=3.4$;

$$TSM_k=3.4 \times 0.314$$

$$=1.07 \text{ sec}$$

$$\text{and third zone setting } t_{h3}=1.07+2t_{ph}$$

$$=1.07+0.5$$

$$=1.57 \text{ sec } (8/9).$$

In fact with third zone setting $Z_{h3}=1.92$ ohms and $t_{h3}=1.57$ sec, a fault located at f_{L3} will cause relay *h* to underreach and remain idle.

In a similar manner we can determine the settings for the relays *a*, *c*, *d*, *e*, *f* and *g* in clockwise direction. These values are listed in table 2.

Finally let us consider co-ordinating feeder and transformer relaying, assuming that transformer overcurrent relays *i* and *k* are placed on the lower voltage side. Grading of relays is carried out as in Fig. 8. Compared with Fig. 7 we notice the operating time of the impedance relays is considerably reduced.

For instance, the settings for relay *e* are derived as follows:

First zone:

$$t_{e1}=0.1 \text{ sec};$$

$$Z_{e1}=0.8 \times 0.62$$

$$=0.5 \text{ ohms.}$$

Second zone:

$$t_{e2}=t_{e1}+2t_{ph}$$

$$=0.6 \text{ sec};$$

$$Z_{e2}=0.62+0.8 \times 10.9 \times 0.266$$

$$=2.32 \text{ ohms.}$$

Third zone: Here we can force the relay to see faults on the distribution feeders:

$$Z_{e3}=0.62+(10.9 \times 0.266)+[5.05 (33/11)^2] 0.266$$

$$=15.7 \text{ ohms.}$$

It is obvious the operating time t_{e3} must be related to the

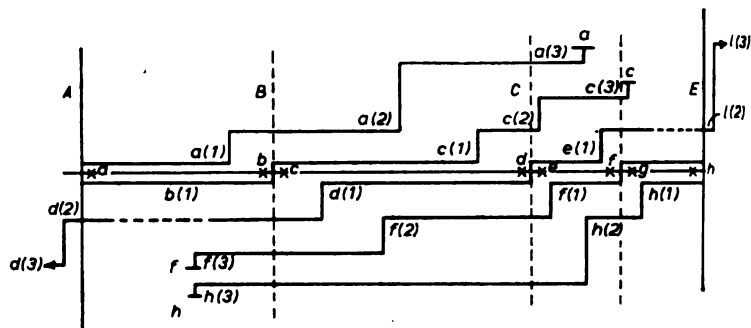


Fig. 8 Grading of inverse time o/c and impedance relays used for network shown in Fig. 6. O/c relay is placed on the low voltage side

overcurrent protection. For an optimum operating time $t_k=1.4$ sec (see Fig. 6 fault f_1) we get

$$t_{e3}=t_k+2t_{ph}$$

$$=1.4+0.5$$

$$=1.9 \text{ sec.}$$

In a similar manner we can determine the settings for the remainder of the relays.

Conclusion

Co-ordination of feeder and transformer relaying can be achieved if the ohmic settings of the impedance relays protecting transmission lines are based on reach related to adjacent line sections, while time settings of the second and third zone are related to the optimum operating time of transformer overcurrent relays.

Dealing with ring mains, substation transformers should be considered as feed-feeders. It is essential to take into account the underreach effects of the impedance relay particularly if small capacity transformers and short line sections are involved.

When placing transformer overcurrent relays on the l.v. side the operating time of the impedance relay can be shortened considerably but the latter is to be regarded as a device for first line of defence. Faults in the diverter compartment of the tap-change transformer are cleared at distance from the substation unless high set instantaneous overcurrent relays are incorporated in the transformer circuit and on the primary side.

Regarding back-up protection for distribution networks, impedance relays associated with delta-star connected transformers may fail to operate correctly. This is due to dissimilar current distribution on the l.v. and h.v. sides in the event of line-to-line and line-to-earth faults on the lower voltage side and operation of the relay initiated by starting relays of the overcurrent type. Doubtful operation should not be ruled out as the starting relays may select wrong voltages. The impedance relays will operate correctly only if faulty h.v. windings are involved. However, for star-tertiary-star transformers, back-up protection for line-to-line faults on the l.v. side will not present difficulties since current distribution on the l.v. and h.v. side is identical. This does not apply to line-to-earth fault. If arc suppression coils are used on the l.v. side, no back-up protection problems will arise. Finally, the use of under-impedance starting relays should be considered as an alternative solution.

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3. A. Salzmann: "Switched Distance Protection," ELECTRICAL TIMES, 3 December, 1959.

Variable speed induction motors

UNORTHODOX "POLE STRETCHING" TECHNIQUE USED

NO more machines have been added to the series of variable-speed induction motors developed at the University of Manchester. Last week, Dr E. R. Waite described the operation of motors operating what has been called the "pole stretching" principle.* The synchronous speed of an induction motor for a given frequency depends on the phase displacement between currents in adjacent stator slots and on the physical spacing of the stator slots. If either of these quantities are varied, the synchronous speed will change. The authors previously described a spherical rotor induction motor in which speed was changed by angling the rotor bars. This effectively altered the spacing between stator slots in the direction of rotation.

"Pole Stretching"

Two new motors maintain the physical spacing of stator slots, but vary the phase displacement between currents in adjacent slots. This technique has been called by the authors "pole stretching." The Logmotor was the first motor described. It has uniformly spaced stator slots, but the conductor in each stator slot is energised from a distinct phase of a multi-phase supply. For a given speed change, the phase displacements between currents in all the stator slots are changed by the same amount. This change in phase displacement is achieved by energising the motor stator winding from a specially designed phase-shift transformer having a multi-secondary winding.

A multi-phase supply can be obtained from phase-shifter. This is similar in construction to a squirrel-cage motor. The end ring of a squirrel-cage rotor winding is removed and the rotor is locked, applying a three-phase supply to the stator will induce multi-phase e.m.f.'s in the rotor bars. The number of phases will be equal to the number of stator bars. Displacing the rotor with respect to the stator will alter the phase displacement between rotor phases, only in relation to the stator phases. However, if a logarithmic distribution is used for the stator and rotor windings, the phase displacements between rotor slots will vary uniformly as the rotor is turned.

The way of obtaining the logarithmic winding is shown in Fig. 2. A conventional stator winding is used for the phase-shifter primary, but it is spaced logarithmically in the slots. Thus, the phase increment between adjacent currents is constant, in this case 18°, but the pole pitch decreases from left to right. With the secondary winding in the position (b), its slots correspond to those in the primary and, provided magnetic coupling is good, the e.m.f.'s in secondary adjacent phases will also be displaced by 18°. The effect of moving the secondary

to position (c), where bar 20 is now opposite primary slot 10, is comparable with relative movement of the C and D scales on a slide rule. If overlap is ignored, any 20 bars in the secondary now span 10 of the primary slots and the incremental phase change between adjacent secondary winding e.m.f.'s is now 9° instead of 18°. Displacement in the opposite direction would result in a secondary e.m.f. displacement between bars of 36°. It will be noted that the change is uniform for all secondary slots and is continuous with rotor movement.

Connection to Motor

If the phase-shifter secondary output is now connected to the motor stator winding, the required change in phase displacement between adjacent slot currents to give a change in speed may be obtained by turning the induction regulator primary. Interconnections between secondary and motor stator are required to convert a logarithmic phase distribution to a linear one.

It is possible to use a uniformly slotted construction for the phase-shifter primary, but to so interconnect the three primary phases that the logarithmic distribution is obtained, and such a winding is described in the paper.

This is the principle called by the authors "phase stretching." It will be noted that the number of output points or phases varies with the overlap of the phase-shifter primary and secondary windings and also that the total phase rotation may not be 360°.

Limitations of Design

There are two important limitations to the method. The first applies to the phase-shifter, for if the primary and secondary are cylindrical and not flat as shown in the development diagram, rotation to position (c) causes that part of the primary from slots 50 to 80 to overlap the secondary slots 10 to 20.

This will mean that part of the motor stator winding will have phase displacements between currents in adjacent slots other than that desired for the speed selected. The speed at which the motor runs will then be determined by the relative magnitude of the desired and unwanted

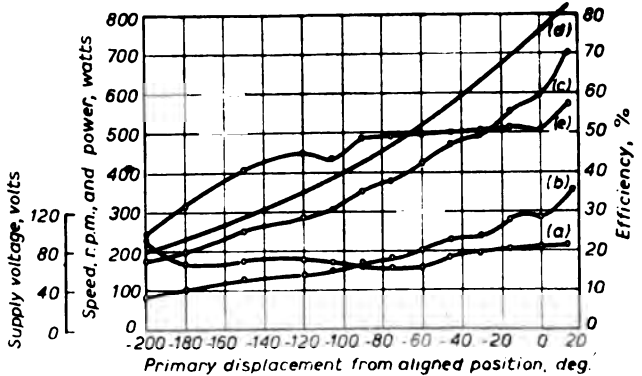


Fig. 1. Logmotor load test (6-pole-primary). (a) supply voltage; (b) output power; (c) speed for maximum efficiency; (d) calculated synchronous speed; (e) efficiency

paper 3149: "The Logmotor—a Cylindrical Brushless Pole-speed Induction Motor"; Paper 3262: "Brushless Pole-speed Induction Motor Using Phase-shift Control." of F. C. Williams, O.B.E., D.S.C., D.PHIL., F.R.S. MEMBER; Laithwaite, M.S.C., PH.D., A.M.I.E.E.; J. F. Eastham, M.S.C.; Carter, M.S.C. GRADUATE and L. S. Piggott, M.S.C., A.M.I.E.E.

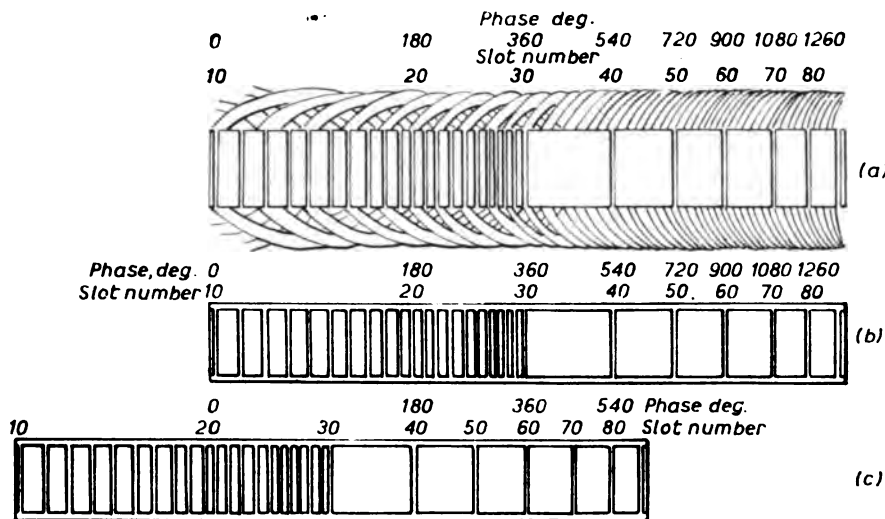


Fig. 2. The principle of phase stretching shown for a developed winding. (a) primary winding; (b) secondary winding; (c) secondary after displacement

magnetic fields. This effect can be reduced by disconnecting secondary coils on the induction regulator overlapped by the primary. The second limitation applies to the motor and is a feature common to all machines where a fractional pole system is used. The motor tends to run at speeds corresponding to an even number of poles. The effect is due to flux "carried over" from the end of the energised part of the stator block to the beginning of the block. It can be overcome by destroying the rotor flux between exit from the trailing edge of the stator block and entry to the leading edge. Additional short-circuited rotor bars added to the stator can reduce the flux "carried over" and improve the speed-phase displacement characteristic, but at the expense of increased losses.

Logmotor Performance

The performance of a small Logmotor constructed by the authors is shown in Fig. 1. Efficiency is low, only about 50% between the speeds of 350 r.p.m. and 700 r.p.m. due to high copper and iron losses. It is thought that these could be reduced considerably by improved design. Peak efficiency occurred at about 20% slip and the motor did not exhibit tendencies to develop crawling torques.

The authors conclude that the experimental machine has proved the principle of "phase stretching" as a method of speed control to be practicable, provided the stator has a break to ensure that the rotor flux in any tooth is destroyed once every revolution. The logarithmic motor has nearly all its stator block available for use, in contrast to the spherical rotor machine.

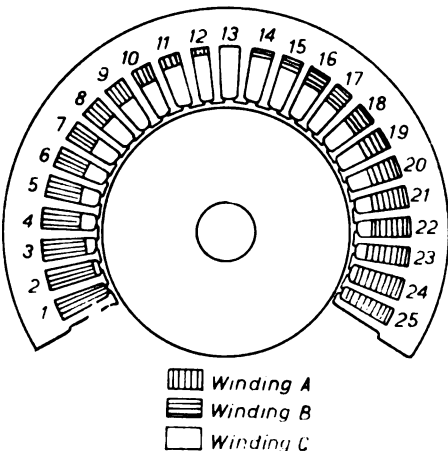


Fig. 3. Arrangement of stator windings in a pole stretching motor for feeding from two 3-phase phase-shifters

Phase-shift Control

The second type of motor described by Dr Laithwaite also obtained its speed variation by varying the phase increment per slot of stator current. But instead of a specially designed phase shifting transformer, two ordinary phase-shifting units were used. The motor had a gapped stator with uniformly spaced slots and three 3-phase stator windings. The windings were disposed in the slots as shown in Fig. 3. Winding C was a 3-phase winding energised from the mains, and in series with both primary windings of the phase-shifting transformers. Each 3-phase secondary of the phase-shifting transformers energised one of the remaining windings on the motor stator. The two phase-shifting transformers were ganged so that they retarded and advanced the phase of

their winding currents by the same angle. The combined effects of the currents in the three stator windings produced a varying number of stator poles when the phase-shifter settings were changed.

If the short stator machine had *n* poles, the output was limited to *n* times the rotor copper loss. This limited the speed range practicable. Speed range was also limited to 2:1 when only two phase-shifters were used, but it would be theoretically possible to obtain a wider speed range by using a more complex winding with more than two phase-shifting transformers.

Tests on an experimental machine fed from two phase-shifters showed that speed control with constant efficiency could be obtained over a speed range of 1.5:1. The motor efficiency obtained was about 66%. Provided the associated phase-shifters were matched with the motor characteristics, overall efficiencies of 62% were considered possible by the authors. The characteristics of the phase-shift control motor, in common with the spherical rotor motor, seemed more suited to a constant power characteristic, but its power/weight ratio would probably be lower than that of the spherical motor.

A conventional mechanical construction was used and windings on both motor and phase-shifters were conventional except for grading of turns. The principal of the phase-shift motor could be applied to construct a motor giving a number of discrete speeds over a given range instead of a continuous variation of speed. The motor required a similar winding to that shown in Fig. 3, but no phase-shifting transformers were required.

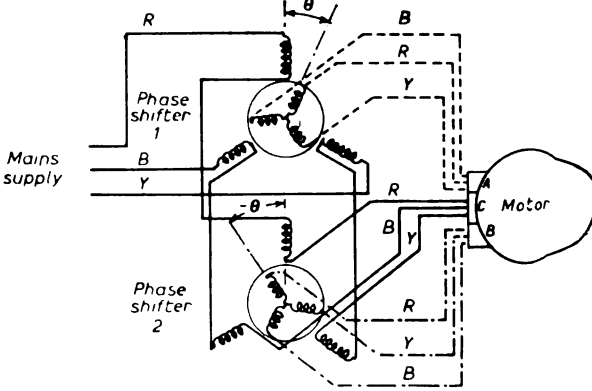


Fig. 4. Connection of motor and phase-shifters

DISCUSSION

The discussion was opened by MR C. C. INGLIS (BTC), who complimented the authors on challenging some past concepts of motor design. He asked whether the motors were reversible. MR A. S. M. ASHWORTH (AEI), asked if there was a lower limit to the practicable h.p. rating of the new motors since the spherical motor was not considered a proposition below a rating of 50 h.p. He also suggested that some difficulties might be encountered in meeting conflicting requirements of numbers of conductors and voltage applied.

PROFESSOR RAWCLIFFE (Bristol University) preferred the phase shift motor to the logmotor. He thought the next step would be to find a means of making available energy lost through having to destroy rotor flux "carried over." He thought the authors too anxious to dispose of brushes and suggested that constant current supply was not a realistic way of specifying performance.

MR J. S. HOLMES (Rotax) referred to

development work on the spherical rotor motor by the aircraft industry. It was at one time thought that this type of machine, operating as an induction generator, could be used to derive a constant frequency supply when driven over the characteristic 2:1 speed range of an aero engine. However, it had been shown that the power/weight ratio was only about half that of a hydraulic drive. The calculations were based on a 40 kVA machine.

MR W. HULL (AEI) took the authors to task for not giving more attention to the economics of machine design and called for a more realistic treatment of this aspect of design in university courses and text books. MR R. D. BALL (English Electric) asked if the authors had considered applying their principles to a hysteresis permanent magnet type of motor running synchronously. He also suggested that a linear motor working on a similar principle to those described might be applicable to planer drives.

In reply, PROF WILLIAMS, and DR LAITHWAITE said although both types of motor were reversible by interchanging two supply phases, it was probable that the logmotor would have a preferred direction of rotation. The difficulty of marrying number of turns required with applied voltage mentioned by Mr Ashworth could be resolved by using an auxiliary transformer. The authors, replying to Professor Rawcliffe, pointed out that the whole object of their research programme had been to design brushless motors. It seemed probable that any attempt to make use of rotor "carried over" power would only result in larger losses. In reply to Mr Ball, the authors said they had considered development of the hysteresis motor. Application of the principle to planer drives was likely to be restricted by the speed requirements. Dr Laithwaite was critical of the basis on which the power/weight ratios mentioned by Mr Holmes were calculated.

15 MW gas turbine alternator for peak power

ALMOST a year ago the South Western Electricity Board brought into service the first of two 3 MW gas turbine-driven generators to meet peak load requirements in north Devon. This week the CEGB announce their intention to place a £200,000 order with Bristol Siddeley for a 15 MW gas turbine-driven generator. The generator installation is to be located at Hams Hall, near Birmingham.

The plant is scheduled for commissioning in September, 1962. It will enable the CEGB to assess the performance of gas turbines, developed from their aircraft counterparts, for meeting peak-load and emergency requirements.

Gas Turbine Unit

The prime mover to be used is based on the Bristol Siddeley "Olympus" turbo-jet engine. It will consist of a gas generator and a free power turbine. The gas generator employs compound axial flow compressors individually driven by separate turbines in conjunction with an annular combustion chamber containing a group of separate flame tubes.

The free power turbine is separate from the gas generator, but directly coupled to the alternator. It converts energy in the gas effluent from the gas generator into shaft output power.

Turbine Characteristics

Gas turbines have a low thermal inertia characteristic which is well suited to quick starting and rapid loading. They can be readily adapted for automatic control and, in fact, both the 3 MW sets installed by the South Western Board are remotely controlled from the Bristol headquarters.

The turbine unit is small, compact and light as instanced by an overall length of 52.5 ft and a total weight of 11 tons, which compares favourably with the generator weight of 60 tons. Fuel consumption is also claimed to be economical and is estimated to be 0.752 lb/kWh. Oil consumption will be 1.5 pints/hr.

The light weight and compact construction of the gas turbine unit means that the building housing it can be relatively small and also that the foundations can be less substantial than for a steam plant.

The associated alternator will be constructed by Brush Electrical Engineering Co. The rating will be 25 MVA at 11 kV. The alternator will run at 3,000 r.p.m. and will have protective stator winding thermocouples.

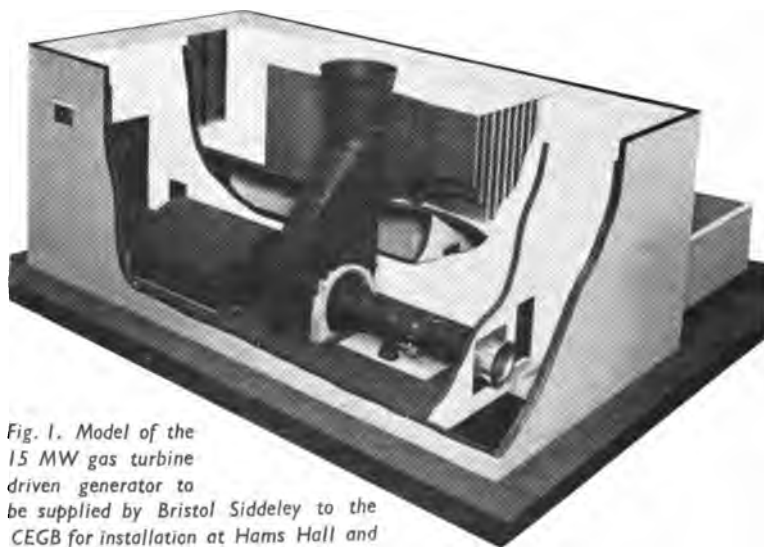


Fig. 1. Model of the 15 MW gas turbine driven generator to be supplied by Bristol Siddeley to the CEGB for installation at Hams Hall and commissioning in September 1962

NOTES ON WIRING

BY M E G O H M

THIS week I paid a visit to the offices and demonstration rooms of the original manufacturer of mineral-insulated copper-sheathed cables. I always consider that an hour or two at these offices keeps me up to date in this field of wiring and also provides me with information about the engineers who use this cable and those who are, at last, finding out its qualities. All the latest improvements and tools are clearly and politely demonstrated, although the cable is, if you will excuse my twisted sense of humour, "stuck up"! Greater use is being made of gum and/or glue for this purpose and results are, I understand, satisfactory. A 19-core cable is on show and this should prove useful to many engineers.

Two new tools were shown to me and these should prove most valuable to the site operative. One tool has been perfected to assist in the application of the screw-on pots and, although simple in design, does a really sound job. The second tool is a stripping tool which speeds up the removal of the copper sheath. Available in two sizes, the tool has a cutter blade made of high carbon tool steel and capable of stripping 2,500 yards of copper sheath without needing to be reground.

Of course, this manufacturer does not stop at his own wares. Also on show were conduit boxes, switchgear and lighting fittings to illustrate the methods of entry, etc., for m.i.c.s. cable. I was particularly interested in a new line of conduit boxes which have been designed specifically for use with m.i.c.s. cables. Special attention has been paid to the finish of these boxes and, after careful research, the manufacturer chose "Sherardising" as the real answer. This finish, it is claimed, offers good corrosion resistance, complete coverage of uniform thickness and perfect electrical conductivity. It is interesting to note that the clip grip on the boxes secures the *pot seal* and not the cable as do certain other makes of boxes. Included in the range is a circular looping-in box, one inch in depth. This range, in my opinion, is about the best I have seen for use with m.i.c.s. cables.

Altogether, a pleasant and satisfying visit and, as always, I gained knowledge as well as having refreshed my memory.

Fuses

My comments under the above heading in the *ELECTRICAL TIMES*, 3 November, 1960, did not, it appears, go unnoticed. Not long after I read the printed version, I had on my desk, via the Editor, a sample of a line marketed by a firm well known for their accessories and rubber-moulded holders, etc. This line consists of a neat card with four cartridge fuses (2 A, 5 A, 10 A, 13 A) held in a transparent cover. Printed on the card is a list of apparatus which should be served by the various fuses. The 2 A size is shown as being suitable for apparatus such as clocks, vacuum cleaners, radio or TV, etc., and the other three sizes have similar information under their headings. The cost of this card and fuses is 2s and it even has a small hole already punched in it so that it can be hung adjacent to the fuseboard position. Apparently, these cards sell in large numbers and appear to me to be an

ideal guide to the ordinary householder who is not versed in the matter of fuses. I have already included in a specification, for half a dozen such cards to be supplied, and intend to continue the idea.

I gathered that the firm concerned agreed with my previous observations on the matter of plugs being sold with fuses fitted of incorrect size, despite the purchaser informing the seller of the particular piece of apparatus intended to be connected to the plug. Their representatives had also had some trouble in trying to convince chain stores to stop selling the glass type fuse for use in plugs, and it seems that the people concerned just ignored any good advice given. These cards of fuses had been designed to deal with such people and I trust that the idea has been successful.

As a matter of interest, I presented one of these cards to each of my two friends who allowed me to examine their plugs and both were really delighted at getting such guidance and in such an attractive finish. I feel that this type of thing should be encouraged by contractors and retailers in an effort to educate the householder.

Sealing Conduits

I was interested in the recent correspondence in the Problems and Practice columns of the various methods used to prevent the ingress of dirt and plaster, etc., into conduits. Corks and wooden plugs were mentioned, but from what I have seen on sites the most common method is to push a piece of paper into the box and trust to luck. At times a rolled-up piece of paper is pushed into the mouth of the conduit, but neither of these methods is really effective. A plasterer is never happier than when he has gallons of water everywhere and his wet brush is generally used with great gusto. Consequently, the paper in the box becomes gradually saturated and often breaks up, with the result that the sodden paper slips down the conduits. The paper is often followed by blobs of plaster and later, when wiring is started, the fun begins. This is *not* pure fancy; I have known it happen.

Of course, we often meet the problem of outlet boxes being either proud of the finished wall or set too far back and this is mainly due to the plasterers and not the electricians. The latter situation may lead to the box being partially, or wholly, plastered over. I have known the plasterer to remove all the packing in the box so that he could make a neat finish around the edges of the boxes, and in doing so dropped lumps of wet plaster into the conduits *then* replaced the packing. When the conduit was found to be blocked it was a "complete mystery" as to how it happened.

What is the real answer to this problem? I feel that it is up to the site man really, for it would be difficult to produce some sort of block which would fit into a switch-box, for instance, in such a way that the conduits would be shielded yet the edges of the box left so that the plasterer could finish his work neatly.

I make no excuses for repeating words used in these columns before: "The site operative has indeed many problems to contend with."

.I.B.A. Ball, 1960

E 1,000 members of the electrical industry, their
and their guests were present at Grosvenor House,
on, on Friday for the annual ball of the Electrical
stries' Benevolent Association. They were received by
resident, Mr R. R. B. Brown, and Mrs Brown, and
dinner entertained by dancing and by a cabaret. Mrs
n carried out a lottery draw in which forty attractive
s presented by firms in the electrical industry were
During the evening a telegram from HM The Queen,
n of the EIBA, was read. The funds of the EIBA
ited by some £2,000 as a result of the evening's
ties.



The president, Mr R. R. B. Brown, and his lady



present included :

*ical Engineers' Exhibition group: Mr R. F. Mathieson between two treasurers; left to right—2, Mr W. F. Parker, Mr A. Crinson and their ladies;
d Mrs W. A. Ankerson, Mr and Mrs R. Farrell; 4, Dr and Mrs Castle, Mr and Mrs Mortimer Hawkins; 5, Mr and Mrs I. H. Leitch, Mr and Mrs
ypte; 6, Mr and Mrs G. Hancock, Mr and Mrs C. Kubale; 7, Mr and Mrs K. S. Estlin, Mr and Mrs J. C. Kubale, Mr and Mrs J. Losemore; 8, Mr and
E. Gibbs; 9, Mr and Mrs E. B. Sawyer, Mr and Mrs J. Christie; 10, Mr and Mrs A. H. Young, Mr E. E. Jacobi; 11, Mr and Mrs S. B. Warder.
Mrs Lewis Smith; 12, Mr J. H. Pendry, Mrs White, Mr R. V. Bank; 13, Mr and Mrs A. L. Francis, Mr and Mrs F. Thompson; 14, Dr and Mrs G.
Armstrong; 15, Mr and Mrs H. G. W. Hill, Col and Mrs W. E. Dennis*

OVERSEAS NEWS



from our correspondents abroad

CANADA

Columbia Plan Agreement

The agreement between the Canadian and United States Governments on development of the Columbia River was reported in *ELECTRICAL TIMES* for 3 Nov. Since then, further information on the Columbia River hydro-electric scheme has become available. Canada is to construct three major storage dams at a total cost of \$450 million including transmission investments. Provided water licences can be obtained by 1961—and some experts doubt if this is likely to be possible—construction work could begin at once and the Canadian storage dams could be completed by 1970, yielding a firm capacity of 1,250,000 kWh as Canada's share of the downstream benefits. The sites for the dams are at Arrow Lakes, Mica Creek and Duncan Lake. The dam at Mica Creek would be the largest, impounding an area of about 8 million acre ft. Development of the American power sites is less specific, but Canada will receive back from the US half of all additional power produced at the relatively low cost of less than 0.4 cents per kWh. Canada will also receive an estimated \$65 million in cash from the US over a 60 year period in return for flood protection provided by the storage dams. Canada retains the right to divert water from the Kootenay River in eastern British Columbia to the upper reaches of the Columbia after 20 years. In return, the US will be granted an option for five years to proceed with construction of a trans-boundary reservoir on the Kootenay by constructing a dam at Libby. If this dam was constructed, Canada would receive substantial benefits in increased power protection and flood control. Mr Diefenbaker said that the Federal Government has offered to finance half the cost of the three storage dams with the province of British Columbia carrying the balance. However, there are suggestions from BC that the State may choose to raise the entire fund on its own.

Village for Nuclear Project Sited

Preliminary site work will begin shortly on the Atomic Energy of Canada Ltd., nuclear research establishment to be built at Whiteshell, between the north shore of Sylvia Lake and the Pinawa Channel, about 50 miles north east of Winnipeg. About two miles from the nuclear site, a village is to be con-

structed for the estimated 500 workers at the establishment. The Whiteshell establishment will concentrate on power reactor development and the first facility to be built there will probably be an organic liquid-cooled reactor, with heavy water moderator.

Shawinigan Earnings Up

Consolidated net earnings of the Shawinigan Water and Power Co. for the first nine months of this year were \$10,431,449, 10½% more than in the same period of 1959. Revenue from sales also rose by 8% to \$60,635,207, but were counteracted by a slightly higher rise of 9% in operating expenses to \$47,765,679 due mainly to higher cost of additional power purchases.

New Hydro Plant For Alberta

Two new hydro-electric generators have recently been brought into service to supplement the Spray Project, completed nine years ago. A 40,000 h.p. hydro generator has been added at Rundle, and a second 62,000 h.p. unit at Spray plant. In the past three years, demand has grown annually at over 13%. When completed the extensions will bring Calgary Power hydro capacity to a total of 411,450 h.p.

QATAR

Cables for New Power Station

A £300,000 cable contract for the new Ras Abu Aboud power station in the Sheikdom of Qatar, and for a system of overhead and underground transmission lines and cables, has been awarded to the BICC group by the Government of Qatar. Installation work is being carried out in two stages by the British Insulated Callender's Construction Co. The first stage consists of laying two 66 kV oil-filled power cables, with pilot cables, to interconnect the new power station with an existing station at Doha, four miles away. A 66 kV transmission line is also being constructed to link with Umm Said and Wakrah, 24 miles distant.

In the second stage, scheduled for 1962, 11 kV power cables will be laid, and control cables to enable the new station and the existing stations at Doha to operate in parallel.

The new station will make power available for a large sea water distillation plant.

GHANA

Rural Electrification

Forty-five towns and villages in rural areas of Ghana will benefit from an electrification scheme recently initiated by the Minister of Works and Housing. A British firm has been invited to carry out an electrification survey immediately. The Minister said that the project would eventually be incorporated into a national electricity network when abundant supplies of power would be available from hydro sources.

INDIA

Steam Plant Contracts

An order for a coal-fired unit boiler for the extension of Hussainsagar power station, Hyderabad, has been placed with Clarke, Chapman and Co. Ltd. This company has also received a second order for a specially designed boiler unit capable of being fired by coal, oil, coal and bamboo sawdust or oil and bamboo sawdust. The boiler is to be installed at the Gwalior rayon silk factory.

Bhakra No. 1 on Load

The first of five 100 MVA hydro-electric generators was recently put on load at the Bhakra power station which is now nearly completed. Part of the £130 million Bhakra-Nangal project, the Bhakra dam which is 740 ft high and 1,700 ft long will eventually supply water to two power stations with a total installed capacity of more than 1,000 MW. The five generators for the first station are being supplied by AEL.

Gift Power Station

The enviable problem of where to site a gift power station now faces Indian engineers. A 250 MW power station, a gift following the last visit of Mr Khrushchev, is to be sited near the Rihand Dam. The problem is whether to site the station on the Singrauli coal fields at Kota, or near to the Rihand hydro power house. Location at Kota will require an expenditure of Rs1.5 crores for a transmission line, but on the other hand, siting near the Rihand power house would require transport of coal across a 30-mile wide lake. Transport by ships or by a ropeway across the lake is estimated to cost Rs30 lakhs or Rs60 lakhs.

A project which has also been approved in principle by the Central and Water Power Commission is utilisation

ihand tail water at Obra, 20 vntstream of the present dam. n, there are alternatives, either ict a 60 MW hydro station at it a cost of Rs14 crores or a station at Obra, costing Rs11

Plans Pruned

of more than Rs65 crores has osed by the Planning Commis- he draft third Five-Year Plan by the Punjab Government. rnmment have decided, however, r generation proposals will be lemented, for even though they it, the State will face a shortage in 1965-66 of 256 MW. The visions in the third Five-Year for an expenditure of Rs20 the Beas project; the right wer station at Bhakra with on line Rs18,74,00,000; thermal Rs5 crores; diesel genera- industrial consumers Rs2 power house on the upper b canal Rs4.5 crores, and the age of the Uhl River power s2,72,00,000. Where the cuts ade in the draft plan is now ked out and the State Govern- also expected to decide soon h it can spend in the first ie third Plan. A total of Rs231 ottoed to the Punjab includes al Government contribution of res. The balance will have to by the State from its own In the second Plan period the ld find only Rs67 crores and, additional resources capable of nother Rs36 crores will have nd for the third Plan period.

AUSTRALIA

River Survey

o-ordinator General of Road aid in his annual report that y field work continued over year on the hydro-electric of the Upper Herbert River rk completed or in hand in- vestigation of possible storage sites on Herbert River and reek and conduit and penstock iding into the Herbert River

Project for Whitsunday

iminary report outlining pro- extend power supply to the lle, Hayman and Long Islands 'hitsunday group was recently by the manager of the Mackay Electricity Board. ed cost of the project is put 0. It would include submarine king the mainland with South id South Molle with Hayman nother cable would link South Long Island. Substations and reticulation would be required ree islands. Total loading of e allowing for future develop- estimated at 1.5 MVA

Steady Progress by S.E.A.

An increase in electricity sales by more than 9% to a new record of 694,409,428 kWh was achieved by the Southern Electricity Authority of Queensland during the last year. Sales yielded £8 million and revenue exceeded expenditure by £342,274. Number of consumers rose during the year by nearly 8,000 mainly as a result of growth in provincial areas. Transmission has been extended further west and the Authority is now supplying bulk power to Dalby. It is also recently reported that the State Cabinet has ordered that the 10% electricity surcharge in the Southern Electric Authority area to be reduced to 5% from 1 Oct. and has initiated negotiations which are expected to result in early removal of the remain- ing surcharge.

New Station at Callide?

Anticipating the results of a special report on future electrical development in Queensland, Rockhampton Council resolved that they would support erection of a power station at Callide or any other place in Central Queensland that might be recommended. The report is being prepared by an English firm of consultants and although it has not yet been tabled in Parliament, rumour has it that it is in circulation.

NEW ZEALAND

Christchurch Results

An increase of 10.5% in units sold by the Christchurch Municipal Electrical Department during the year ended 31 March last was higher than anticipated. There is to be an adjustment of

tariffs in the current year in order that approximately half of the annual capital expenditure shall be obtained from revenue. The year's operations resulted in a trading surplus of £10,983—5.85% of turnover—and was noteworthy in that the load factor rose to over 50% for the first time in a normal year's operations. Mr G. H. Battersby, the general manager, points out that the load factor has been built up to that figure by the use of the ripple system for controlling the water heating load, and has been achieved without any water heaters being disconnected for more than two hours at a time. An additional 2,331 electric cookers and 2,546 water heaters were connected during the period covered by the report.

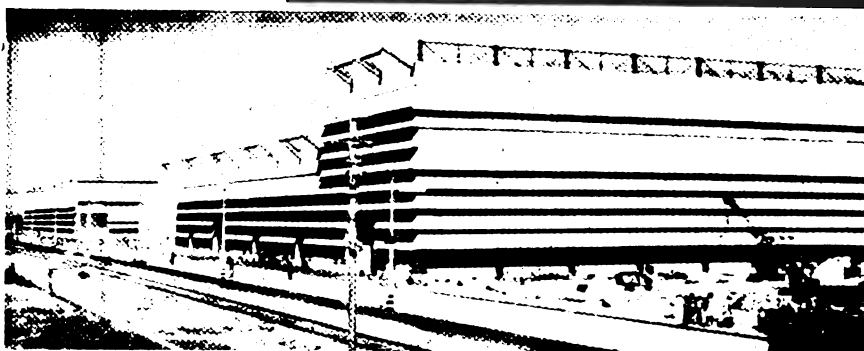
Water Turbine Order

Three 42,000 h.p. vertical Francis turbines have been ordered by the New Zealand Electricity Department from Boving and Co. (ANZ) Pty. The turbines will be installed at the Aratiatia power station on the Waikato River in the North Island. The turbines will be designed to operate under a head of 110 ft at a speed of 136 r.p.m. and will be delivered in 1962-63.

Geothermal Pipework

Contracts worth more than £900,000 have been awarded to Aiton and Co. for the supply and erection of pipework and ancillary equipment for the new geothermal natural steam project at Wairakei, on the North Island of New Zealand. The supply contract, worth £578,660, was obtained from the New Zealand Government, and that for the erection, valued at £323,323, from Waite-Tileman who are also contractors.

The Prime Minister of India, Mr Nehru, with Lal Bahadur Shastri, Indian Minister of Commerce, at the opening of Heavy Electricals, Bhopal. The managing director of AEI Overseas, Mr F.J.E. Tearle, and the director of engineering, Mr W. L. Beeby, are on the right



Exterior of part of the Bhopal factory, opened by Mr Nehru on 6 November

Personalities *in the industry*

Two new district managers have been appointed by the London Electricity Board—**Mr J. P. Tanner**, A.M.I.E.E., for the North Western district, and **Mr R. D. Goodson** for the South Eastern district (*ESH, pages 77 and 81). Mr Tanner, who has been engineer to the Board's Northern district since 1957, was sub-area design and planning engineer for the previous nine years. Prior to nationalisation of the industry he was borough electrical engineer at Stoke Newington for a year, after serving with the St. Pancras undertaking from 1939. There he successively held the positions of assistant meter superintendent, deputy consumers' engineer and, ultimately, consumers' engineer. He obtained early training with Mumford and Sons, later joining the Plymouth Corporation undertaking and, subsequently, gained experience at Finchley and Stafford. Mr Goodson has also held his present post—district commercial engineer for the Board's South Eastern district—since 1957. He started with the Croydon Corporation undertaking following training at the Croydon and Regent St Polytechnics. Later he served at Brighton and with the County of London Electric Supply Co., until war service interrupted his career. Afterwards he was assistant district consumers' engineer with that concern and, from 1948 to 1950, was district commercial officer with the LEB at E. Wandsworth. He then became district commercial officer at Wimbledon and from 1951 to 1957 was a branch head in the Commercial Dept. at the Southern sub-area.

Mr K. Hartshorn has joined the General Electric Co. Ltd. as advertising and marketing manager of its Radio Group.

Troughton and Young (Lighting) Ltd. announce that **Mr A. B. Read**, R.D.I., has rejoined them as design consultant. Mr Read will also continue his association with Carter and Co. Ltd. in a consulting capacity.

At present managing director of William Doxford and Sons (Engineers) Ltd., **Mr Robert Atkinson**, D.S.C., R.D., B.Sc., M.I.MECH.E., M.I.MAR.E., has been appointed managing director of the Engineering Division of Tube Investments Ltd. with effect from 1 March, 1961.

London Transport announces that **Mr H. W. Hadaway**, A.M.I.E.E., M.I.R.S.E., has been appointed a principal executive assistant in the Signal Engineer's Department with the title of installation engineer (signals). He will be responsible for installing, testing and passing out all new installations and major renewals of all types of signalling equipment. A

member of the Council of the Institution of Railway Signal Engineers, he was awarded the Institution's first prize in 1950 for his paper on "Improvements in Track Circuit Shunts." He originally joined the London Electric Railways in 1927 as a signalling apprentice and, shortly after completion of his apprenticeship, was appointed a technical assistant. He became an executive assistant in 1946 and a senior executive assistant three years later.

Mr A. B. Skevington, acting manager of Phillips' Nottingham branch since September, 1959, is now appointed branch manager there. He joined the Nottingham branch in 1949 as a lighting representative and was promoted a sales supervisor in May, 1955. Two years later he was made area manager of the Electrical Appliances Group.

The Hon Sir Arthur Howard, K.B.E., C.V.O., D.L., J.P., has been reappointed a part-time member of the South Eastern Electricity Board.

Aerialite Ltd. have appointed **Mr Ian McKay** as their technical representative for their Floor-warming Department in Scotland.

Mr D. Shelton has been appointed manager of the Newcastle upon Tyne branch of Dictaphone Co. Ltd. He was previously at their Manchester branch office and succeeds **Mr B. Legat**.

Mr H. C. Margrett, general manager and a director of GEC Overseas Services Ltd.—a subsidiary of the General Electric Co. Ltd.—has retired after 40 years' service with GEC. Educated at King Edward's School, Birmingham, where he was a Foundation Scholar, Mr Margrett went to the University of Birmingham where he graduated as a Bachelor of Commerce. He joined GEC as a commercial trainee and, subsequently, became commercial assistant in the newly formed Oram Valve Department. In 1934 he was appointed assistant manager of the Southampton branch and in 1936 became manager of the Hong Kong branch of the General Electric Co. of China Ltd. From 1942 to the end of

the war, Mr Margrett was imprisoned by the Japanese in the Stanley Internment Camp, Hong Kong. After rehabilitation leave, he returned to Hong Kong. In 1950 he was appointed assistant managing director of the British General Electric Co. Ltd. Hong Kong and, in 1951, became managing director. While in Hong Kong, Mr Margrett became a Justice of the Peace. Returning to this country in 1953 he became manager of the GEC Business Development Department at head office and, in 1959, was appointed general manager and a director of GEC Overseas Services Ltd.

The BBC announces the appointment of **Mr J. D. MacEwan**, B.Sc., A.M.I.E.E., A.M.BRIT.I.R.E., as engineer-in-charge, television, Birmingham, in succession to **Mr H. G. Whiting**, A.M.I.E.E., who recently became regional engineer, Midland region. Mr MacEwan joined the Operations and Maintenance Department of the BBC in 1947 and after service in Glasgow and Edinburgh he became a member in 1953 of the staff of the BBC's Television Outside Broadcast unit covering Scotland and north-east England. During the following year he was transferred to the television staff in Glasgow. In 1956, Mr MacEwan was appointed senior lecturer (technical operations) at the Corporation's Engineering Training Department, Wood Norton, Worcestershire, which post he has held until taking up his new duties in Birmingham on 14 Nov.

Mr J. F. Taylor has been appointed as a representative of the M-O Valve Co. Ltd.—a subsidiary of the General Electric Co. Ltd.—for the GEC range of domestic valves and TV tubes.

Mr L. C. Jesty, B.Sc., M.I.E.E., has been appointed manager of Sylvania-Thorn Colour Television Laboratories Ltd., in succession to **Mr B. C. Fleming-Williams**, B.Sc., A.M.I.E.E., who has left the company and is now on a visit to the USA. We understand Mr Jesty joined the laboratories in 1957 and has been mainly responsible for the research and development programme on colour television and cathode-ray tubes. **Mr J. K. Oxen**



Mr J. P. Tanner



Mr R. D. Goodson



Mr H. C. Margrett

* Denotes revision to the "Electricity Supply Handbook, 1960."

M.A., who has been in charge of work on colour and closed circuit on, has been appointed deputy er.

the centralising of activities of Electronics Ltd. certain individual sibilities have been reorganised.

L. Stride, formerly manager of almesbury Wks, becomes manager Aviation Division, and Mr P. J., previously chief electronics r, becomes manager of the Nucle- und Industrial Division. Mr E. B. son continues handling the com- l activities of both divisions as anager.

P. L. Edwards has retired from inagership of the Dublin office of ated Electrical Industries Export lthough he will continue for a s consultant. He is succeeded as er by Mr J. W. Jackson, pre- deputy manager of the Dublin Mr Jackson served his apprentices- ith Mather and Platt Ltd. and Metropolitan - Vickers' Motor Dept. in 1929. After a period with efield district office he was at the w office from 1936 to 1955, when ame manager of the company's sub-office. On the integration of V and BTH companies' offices in r, 1959, he was appointed deputy er of AEI Export Ltd., Dublin office. Mr Edwards, a past- nt of the Society of Irish Elec- traders, had been manager of the office since 1932, having started BTH in 1923 after periods with and Harland and Wolff Ltd.

F. C. Williams, O.B.E., D.S.C., F.R.S., was last Thursday pre- with the John Scott medal and The presentation was made by H. Osgood, scientific attaché to merican Embassy on behalf of the rust of Philadelphia. The award ade in recognition of Professor ns' work on the "Identification or Foe" system developed in the world war.

many years manager of the GEC 1 Picture and Television Section, B. Hartley, F.B.K.S., A.R.P.S., has now joined Superlamp Ltd. ll continue to concentrate on the id television studios industry.

ral new appointments in the Sales n of Servis Domestic Appliances nounced. Mr L. H. Brneton be- sales promotion manager (UK); . Lucas is assistant home sales er; and Mr A. A. Conway n sales manager. Two divisional nanagers are: Mr W. Lucas, for and the West, and Mr R. V. s for London, N.W. In addition, . C. Leary is public relations

G. A. Marriott, managing direc- the M-O Valve Co. Ltd., a wholly subsidiary of the General Electric d., has intimated his intention to in March next year. He will be led as managing director of the ny by Mr J. Bell, B.S.C., F.INST.P.,



Mr L. C. Jesty



Mr J. W. Jackson



Mr G. A. Marriott

who is at present deputy director and manager of GEC Research Laboratories and a member of the M-O-V board.

Prof A. C. B. Lovell, O.B.E., F.R.S., professor of radio astronomy in the University of Manchester and director of the Nuffield radio astronomy laboratories, Jodrell Bank, has been awarded a Royal Medal by the Royal Society for his distinguished contributions to radio astronomy.

Mr E. V. Beaton, of Joseph Lucas Ltd., has been appointed by the Council of the British Welding Research Association to serve on the Association's Research Board. His principal fields of interest are resistance welding and brazing.

Previously a director of the Key Engineering Co. Ltd., Mr F. V. Whickham, A.M.I.C.E., M.R.S.H., has joined the board of Temple Tubes Ltd., manufacturers of pitch fibre pipes and conduit. The latter concern is a subsidiary of Limehouse Paperboard Mills Ltd. Mr Whickham will be concerned particularly with co-ordination of product development and sales.

Formerly group commercial director of the Solartron Electronics Group, Mr E. E. Jones has relinquished that position to become managing director of Adrema (Holdings) Ltd.

Mr G. Hofman, managing director of Philips Electrical Ltd., recently completed 40 years' service with the Philips' organisation.

Mr H. G. Houghton has been appointed chairman of the Engineering and Lighting Equipment Co. Ltd. following the death last month of the Earl of Verulam. Mr Houghton thus becomes chairman and managing director, with Mr F. Webster as deputy managing director, and the other members of the board are: Mr C. S. K. Benham, Mr C. G. Maynard, and Mr R. Proctor, who is also company secretary.

Mr P. Jardine, group financial controller of Metal Industries Ltd. has been appointed to the boards of two of the subsidiaries in that group, J. G. Statter and Co. Ltd. and Minerva Mouldings Ltd.

AEI Lamp and Lighting Co. Ltd. have appointed Mr A. B. Frost the assistant manager of their Midland sales region. Mr Frost was previously assistant to the

regional manager and from 1955-1958 the Northampton area manager.

Mr C. R. Hughes, mechanical engineer in the No. 3 (South East Durham) area of the Durham Divisional Coal Board, has been appointed chief engineer in the area. From 1946 to 1949, when he returned to Durham, he was electrical engineer with the Shipley and Ilkeston Collieries Ltd., Derbyshire.

To mark his retirement after 40 years' service in the industry, Mr W. B. Gold, area workshops engineer for Monmouthshire and Mid-Wales, South Wales Electricity Board, was presented with a colour slide projector and screen by Mr D. G. Gwyn, the Board's area manager, recently.

OBITUARY

Dr G. W. O. Howe, Emeritus Professor of Electrical Engineering at Glasgow University, died on 7 Nov., aged 84. He held the James Watt Chair of Electrical Engineering for 25 years until retiring in 1946. He was in charge of the electrical engineering department at Hull Municipal Technical College before being appointed a lecturer at the City and Guilds Engineering College in 1905. Four years later he became assistant professor of engineering. When he was appointed to the James Watt Chair at Glasgow in 1921, he was head of the department of electrical standards and measurements at the National Physical Laboratory, Teddington. Prof Howe was president of the engineering section at the meeting of the British Association at Toronto in 1924 when he surveyed 100 years of electrical engineering down to the beginnings of radio telegraphy and telephony. In 1956 he was awarded the Faraday Medal of the IEE for his pioneering work in the study and analysis of h.f. oscillations and on the theory of radio propagation, and for his outstanding contributions to engineering education. Dr Howe was editor of the *Wireless Engineer* from 1926 to 1954.

Mr R. Lawler, manager of the Electronics Division of Ferguson Radio Corporation Ltd., died on 2 Nov., aged 59.

Mr J. R. Hall, A.M.I.E.E., formerly deputy borough electrical engineer at Accrington, died recently, aged 74. He retired in 1950 after serving in the Corporation Electricity Dept. for 46 years.

NEW LITERATURE

World Railways, 1960

Edited and compiled by H. Sampson

RAILWAYS continue to exert a remarkable fascination, even though steam locomotives are rapidly giving way to their modern electric and diesel counterparts. The extensively revised sixth edition of "World Railways" contains much information on how modernisation is proceeding both at home and overseas. Not only is this a valuable book for the enthusiast on railways, it is also of great importance to manufacturers and operators of rail systems, for it contains leading details of more than 1,500 of the world's railway organisations. The first section outlines under 32 headings particulars ranging from locomotives and rolling stock types and numbers, through passenger and freight loading, to figures of revenue and expenditure where these are available.

In a more detailed subsequent section 125 of the major systems are dealt with as a whole, country by country. This section includes information on the various manufacturers' products. Two other sections outline 33 underground systems and give details of diesel railway traction units manufactured by 50 builders throughout the world.

Many interesting facts emerge from a glance through the pages. For example, British Railways' modernisation plan has now been brought forward so that many of the objectives originally planned for 1970 seem likely to be attained by 1963. It is comforting to note that with the controversy over British Railways' modernisation system in mind, both Russia and China have sufficient faith in electrification to have planned over 14,000 miles in the next few years. Published by Sampson Low's "World Railways" Ltd., price £5 5s, 412 pages, 12½ in. by 8½ in. 653 photographs, 141 maps and 80 diagrams.

on the production of a new series, *Survey of Energy Resources*, the first of which will appear in 1962. The surveys will contain authoritative estimates with an editorial summary and will appear at six-yearly intervals, coinciding with the Plenary meetings of the World Power Conference. Published by Percy Lund Humphries for the Central Office, WPC. 216 pages, 11 in. by 8½ in. Ninth edition, price 70s.

Selected Semiconductor Circuits Handbook

Edited by S. Schwartz

ALL experimenters with semiconductor, professional or amateur, will welcome this book. It was, indeed, a happy thought to invite American designers of semiconductor circuits to contribute their ideas to a handbook for the help of others. These have been grouped into ten sections, each concerned with one particular field of application, and each section subdivided into a design philosophy and a selection of proven circuits which are described in detail. In many cases the name of the contributor is given.

The book is profusely illustrated with diagrams of exceptional clarity while the text incorporates such formulae as may be required, but is otherwise free from abstruse mathematics. It is essentially a practical book. Published by Chapman and Hall, 450 pages, 9 in. by 5½ in. price 96s.

N.C.B. Standards

200 amp Medium Voltage Flameproof Air-break Circuit Breaker. NCB Specification 209/1960. Price 1s. This specification supersedes P7/1950—Flameproof Circuit Breaker, which is now withdrawn. The main differences between the present and original specification are the inclusion of extra requirements in relation to the isolator design, an additional clause on interlocking and the introduction of Type Testing and Inspection clauses. There are also minor alterations in other clauses and the sequence has been rearranged. As from 1 Jan., 1961, all requisitions for 200 A 4.5 kA r.m.s. medium voltage flameproof air-break circuit-breakers, for use in Group 1 gases and vapours only, must conform to this specification. If equipment complying with this specification is required for use in gases other than Group 1, prior certification for that group is necessary.

30 amp Medium Voltage Flameproof Air-break Electrically Operated Gate-end Box. NCB Specification 195/1960. Price 2s. This is one of three specifications for gate-end boxes issued for and by the authority of the National Coal Board. It covers the design, performance and test requirements for 30 amp flameproof air-break electrically operated gate-end boxes for use on 3-phase 50 c/s a.c. circuits up to 650 volts for controlling motors not exceeding 20 h.p. rating. Three drawings included give the required dimensional limits and tolerances for busbar chamber terminals, flanges and connectors, skid coupling arrangements and outgoing cable fittings.

Copies of the above specifications may be obtained on request to the National Coal Board, Hobart Hse, Grosvenor Sq, London S.W.1.

Statistical Year Book of the World Power Conference

Edited by F. Brown

THIS is the ninth and last issue of the annual statistical summaries covering the period 1954-57 which have been prepared by the Central Office of the World Power Conference. It has been decided to leave future collation to the Statistical Office of the United Nations. The Central Office will now concentrate

BOOKS RECEIVED

The Testing of Electrical Machines, by L. H. A. Carr. Test-book for use by test staff and inspecting engineers, assuming HNC qualifications. Published by Macdonald and Co., 299 pages, 8½ in. by 5½ in. Price 50s.

Electronic Equipment Reliability, by G. W. A. Dummer and N. Griffin. Summary of present knowledge of factors affecting reliability for designers and electronic equipment users. Includes as well design technique and testing methods. Published by Pitmans, 274 pages, 8½ in. by 5½ in. Price 45s.

Manipulation of Thermoplastic Sheet, Rod and Tube, by J. M. J. Estevez and D. C. Powell. Surveys principal thermoplastic materials commercially available and methods by which they can be fabricated. Published by Iliffe and Sons, 8½ in. by 5½ in., 148 pages. Price 27s 6d.

Simplified Short-Circuit Calculations, by R. T. Lythall. Details and data of short-circuit calculations for 400 and 600 V group motor control and switchboards. Published by the Belmos Co Ltd., 27 pages, 8½ in. by 5½ in. Price 5s.

A First Course in Television, by "Decibel." Working principles explained for readers with some knowledge of radio. Published by Sir Isaac Pitman, 149 pages, 7½ in. by 4½ in. Price 15s.

Redgrave's Factories, Truck and Shops Acts: Supplement to 19th Edition, by John Thompson and H. R. Rogers, noting new Court decisions and regulations. Published by Butterworth and Co., 152 pages, 6½ in. by 4½ in. Price 15s.

Boiler House Practice, by J. N. Williams. Covers City and Guild exam. syllabus in boiler house practice. Published by George Allen and Unwin. 648 pages, 9½ in. by 6 in. Third edition. Price 70s.

The Use of Welding in Steel Building Structures, by G. B. Godfrey. Guidance on design of metal arc welded steel buildings in conformity with BS 449:1959, under nominal static loading conditions. Published by British Constructional Steelwork Association, 35 pages, 11 in. by 8½ in. Price 3s 6d.

Translation from Russian for Scientists, by C. R. Buxton and H. S. Jackson. Designed to enable scientists to acquire adequate reading knowledge of Russian language. Published by Blackie and Son Ltd., 299 pages, 8½ in. by 5½ in. Price 30s.

Proceedings of the International Clean Air Conference. Record of 78 papers on clean air topics presented to London conference in October, 1959, together with discussions on them. Published by the National Society for Clean Air, 290 pages, 9½ in. by 6½ in. Price 30s.

Principles and Practice of Aircraft Electrical Engineering, by H. Zeffert. Comprehensive review with emphasis on design problems. Published by George Newnes Ltd., 726 pages, 8½ in. by 5½ in. Price 90s.

Cabma Register of British Industrial Products for Canada, 1960-61. This eighth edition, completely revised, provides in five sections a classified list of products, French glossary, British manufacturers, Canadian distributors, and trade names of the various firms. Published by Iliffe and Sons Ltd., 636 pages, 9½ in. by 7 in. Price 15s.

Extending an Aluminium Plate and Strip Mill

POWER SUPPLY AND LIGHTING DETAILS

EXPANSION of the Alcan Industries aluminium plant at Rogerstone is being carried out under a million four-year programme consisting on the existing continuous mill, laid down at the Rogerstone in 1949 and 1950. The new work involves installation of new equipment, relocation of some existing equipment and relocation of some plant items to improve work flow. Outstanding in the plant is a 144 in. hot reversing mill, but there is much electrical interest in the Rogerstone.

Fig. 2 shows the flow chart for part of the revised layout. Whereas the hot rolling layout in 1950 consisted of the 96 in. mill used as a break-down mill, an 84 in. roughing mill and 88 in. finishing mills in tandem, the flow from ingot to strip now consists of a 144 in. four-high mill which can either be for breaking down or for wide plate, the 96 in. mill and 88 in. four-high hot-finishing mills, as a three-stand mill in tandem. A hot reversing mill has been installed by Davy and United Engineering Co. with electrical drives controlled by AEI.

City Supply and Drives

In the continuous strip mill was run in 1949-50, the supply system was organised to allow a 66 kV supply brought into a new substation on the site. The feeders were connected via outdoor duplicate busbars to 20 MVA and one 15 MVA transformers, feeding on their primary sides a duplicate busbar to a switchboard. This switchboard had existing ring mains and new ones by radial feeders. In the replanning is movement and regrouping of existing substation, rather than creation of extra. In some areas, temporary substations have been established to give flexibility for future expansion schemes which only the broad outline is at present. According to Fig. 2 for some indication, the swarf remelt department of the plants which has had to be moved to a new site. It is concerned with melting swarf and light scrap and its purpose uses two mains-frequency induction furnaces, each rated at 600 kW. An aluminium bath holds scrap acts as a secondary for the current. 10 V supply is taken to the furnace from Scott-connected transformers

in an existing substation, which was amongst those moved to a new site. Correction of power factor is obtained by a bank of capacitors connected to a system of aluminium busbars. (Extensive use of aluminium conductors in one form or another is, not surprisingly, a feature of the installation at Rogerstone.) The substation is to be used in the future for supplying new pumping equipment through English Electric switchboards with built-in Donovan starters.

Supply to the 144 in. hot mill is taken through substation equipment which already existed, but which was resited in the mill motor room basement. The mill has an installed load of about 12,000 h.p. To supply the main 11 kV switchboard, existing 0.4 sq in. feeders were extended, and a third feeder was run in aluminium-sheathed paper-insulated cable.

Large m.g. sets associated with the mill are supplied at 11 kV, with 400 V circuits in the mill area fed through a 100 ft long open panel incorporating a bus-section switch and two incoming feeder switches, each of 1,200 amp capacity. The feeders are supplied through two 750 kVA Crompton transformers. From the substation are run two 11 kV cables supplying subsidiary substations, one for auxiliaries associated with the four oil-fired pre-heating furnaces, the other powering the pump house dealing with roll coolant for the mill.

Each of the subsidiary substations has a 750 kVA Crompton transformer, through which are supplied various local switchboards (English Electric). Amongst the equipment supplied is 100 kW immersion heaters. Five heaters warm the

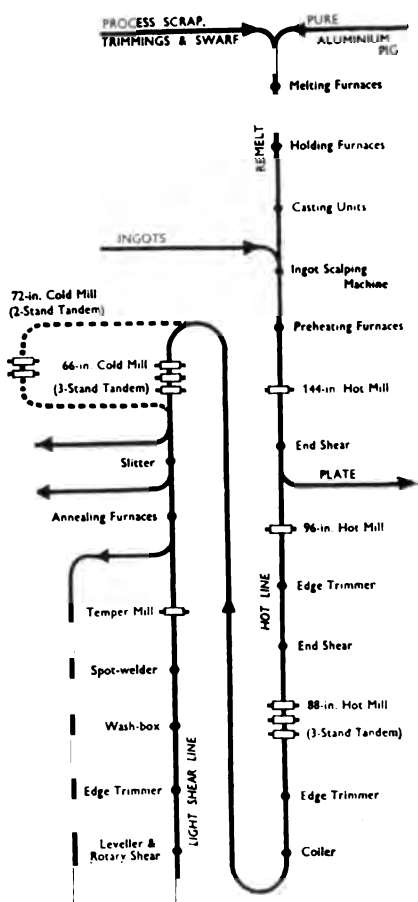


Fig. 2. Layout for plate and strip line. Output may be in the form of container sheet, general sheet products, circles or building sheet, as well as plate. The dotted section will come into operation next year

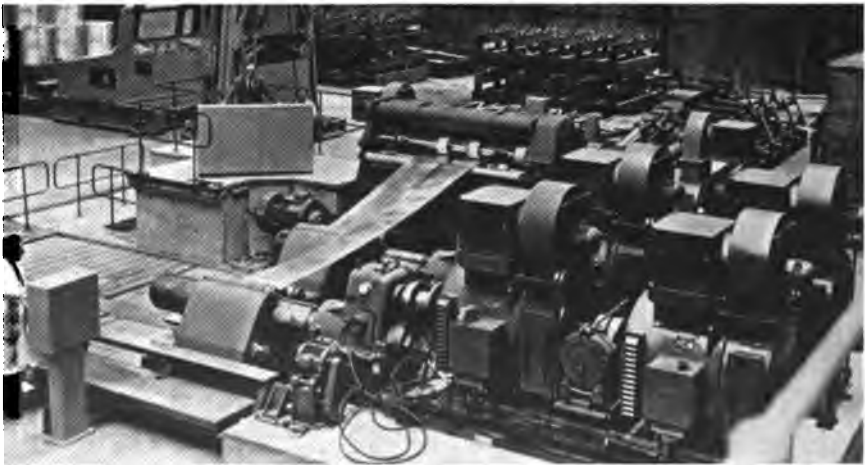


Fig. 1. 72 in. slitting line in the cold mill, showing slitting in process

soluble oil used in the roll coolant system to a working temperature of up to 150°F. The coolant loses heat to a 1,500 g.p.m. cooling tower system (Davenport Engineering). Auxiliary equipment on the pre-heating furnaces is controlled by Donovan contactor panels.

An additional stand has been provided on the 88 in. hot-finishing mill installation. All three stands are now powered by a rectifier installation. Mill motors are rated two at 4,000 h.p., one at 2,600 h.p., and are described later in this article. An AEI 11 kV switchboard supplies, in addition to the mill motors, a 1,000 h.p. synchronous motor-generator set. This provides power for down-coilers located immediately after the mill and gives the necessary power factor correction at the substation. 400 V auxiliaries are again supplied through a 750 kVA Crompton transformer.

Furnaces

Expansion to the cold-finishing facilities involved installation of two oil-fired annealing furnaces, a high-speed slitting machine and handling equipment with capacity to handle coils up to 9,000 lb.

Each of the new furnaces includes eight 55 h.p. fan drives and these, together with other motor loads, are controlled through Brookhirst Igranic contactor panels, with supplies through English Electric switch- and fuse-boards, in turn controlled by air circuit-breakers. Two Crompton 750 kVA transformers give the 400 V supply to these boards, taking their 11 kV supply from an existing substation some distance away. As in all such cases, inter-tripping of h.t. and l.t. switches is provided for and remote trip buttons for the 11 kV breakers are fitted on the 400 V switchboard.

In a future extension of the cold mill an existing 72 in. two-stand tandem cold-finishing mill will be installed with new driving motors to give increased speed and power. The 2,200 h.p. motors

involved will be supplied from existing m.g. sets formerly used on the 88 in. mills now changed to rectifier drives. A further two 2,200 h.p. motors may be added later. A new substation is being built for this mill, supplied from the main substation through two new 0.4 sq in. feeder cables. Mill auxiliaries will be controlled through a cubicle-type English Electric switchboard.

Electrical Details

Having established some of the electrical plant changes at particular locations, the general electrical distribution background may be considered. At the main substation, existence of a considerable reserve of transformer capacity limited the extra installation needed to meet the greater electrical load. Changes have, in fact, been confined to addition of an oil-circulation pump and fan cooling to uprate the existing 15 MVA transformer to 21 MVA and so make it fully interchangeable with the other two 20 MVA transformers. The 11 kV switchboard at the main substation has been extended by the addition of three new panels to accommodate additional feeders.

Cables for 11 kV have copper conductors, but are aluminium-sheathed. Although sizes of up to 0.4 sq in. with drawn-down aluminium sheaths have been used, a change was made to corrugated-sheathed types as soon as they became available, because they are considered to have greater flexibility, superior serving and to be cheaper.

In general, plant wiring has been carried out in p.v.c.-insulated, p.v.c.-sheathed single-wire-armoured and p.v.c.-sheathed-overall cable, conductors being stranded aluminium. In control cabling a minimum size of 7/029 in. has been adopted for reasons of robustness. Since current carrying capacity is not a factor, aluminium conductors of this have been used, with saving in cost.

One of the particularly interesting aspects of the cable installation is the

use of Solidal cable, the recently introduced design which incorporates three solid sector-shaped aluminium conductors, p.v.c.-insulated, with a concentric neutral formed by a single layer of rectangular aluminium wires (ELECTRICAL TIMES, 4 June, 1959). This has been used for all control and three-phase cabling of above 100 amp rating (Fig. 4).

Solidal cables were selected for this duty as being cheaper than other types, and because their light weight and flexibility was considered greatly to simplify installation, 150, 200 and 300 amp ratings are used. Joints in the cables are made by indent-compression and by soldering using abrasion soldering techniques. Terminals on the concentric neutral were made using standard cone-grip clamps.

MICC cable has been used for furnace wiring. Where large single-core cables have been used as in d.c. work, butyl-rubber insulation has been used with flexible stranded-copper conductors. For transformer secondary connections, paper-insulated aluminium-sheathed and served cable has been used.

Cranes

Some large cranes have been installed in the course of the expansion scheme. They are supplied at 460 V d.c. through grooved-wire downshop leads and collector gear (BICC). Crane controls are either Igranic contactor type or de Rema pattern controllers supplied by V. C. Howells. Crane motors are mainly Laurence Scott and Electromotors, except on the ingot handling crane, for which AEI mill-type motors are used. Igranic brakes are generally employed.

The ingot crane is exposed to furnace heat when extracting ingots. It has an air-conditioned cabin and is linked to the mill intercommunication system by a Marconi v.h.f. radio.

Lighting

Lighting fittings in the mill area use 1 kW horizontal mercury lamps by A. Lamp and Lighting, blended with 1 kW tungsten lamps. They are installed under the roof trusses, 50 ft above floor level. Because of the height, there is not a glare problem that might be expected from such large light sources; it has been found that a mounting height of 30 ft would have been practicable from this aspect. The fittings are switched in three-phase groups, but each has a local isolating switch to make maintenance safer.

In another building where the atmosphere is cleaner, an excellent installation has been obtained using twin 8 fluorescent fittings mounted 47 ft high on rows of continuous trunking (F. Stadelmann).

For minor lighting installations, 5 instant start fluorescent fittings are used. Lighting intensities range from 15 lumens/sq ft in the general mill area up to 25 lumens/sq ft in control rooms.

88 in. Mill

The three stands of the 88 in. mill are powered by separate motors.

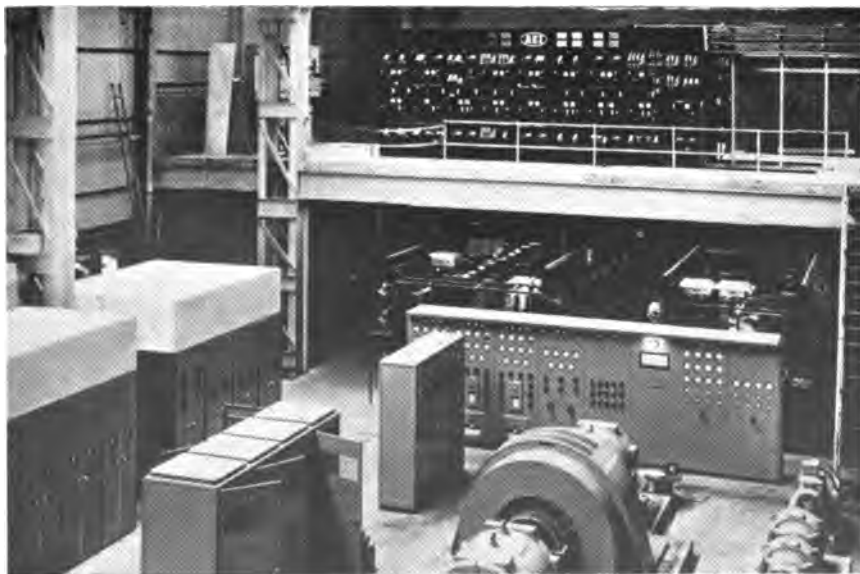


Fig. 3. 11 kV switchboards for 88 in. hot finishing mill and down-coiler

nd second have new motors of i.p., 675 V, whilst the outgoing stains its 2,600 h.p., 202/404 r.p.m., motor.

rol is provided by uni-directional oop speed controls, the power supplied by separate banks of itrolled mercury-arc rectifiers for and. Speed changes, up to base are effected by variation of the output and thereafter, up to base speed, by field weakening. "speed" selection is switch-con by the mill operator, who is also d with a "fine speed" lever-d potentiometer control for each The control system is sufficiently o maintain the actual mill speed in $\pm 1\%$ of the selected speed e range of 60% to 200% of base

downs are Ward-Leonard-con- Duplicate master-control switches ilable at the individual control on the side of the mill stands, as in the control cabin.

choice of rectifiers for the supply mill motors was governed by the y of providing equipment that e built into the limited space e, whilst at the same time making n for a possible future fourth The use of rectifiers was an ideal owing to the smaller area required ompared with m.g. sets of equal Furthermore, the additional power nents were in this way obtainable the further increase in fault inherent in the use of additional driven by synchronous machines. alterations involved an almost e change of control equipment ice this could not be fitted into control cabin, connected, and during the normal "shut-down" a new control cabin was installed. temporarily placed behind the old hile the controls were installed ed to the new control equipment. the "shut-down" the old cabin laced by the already-wired new

oiler

t provision has been made for down-coilers, only one has been under the present development. ler is driven through a reduction , having alternative ratios of id 13.7/1, by either one or two ., 375/1,100 r.p.m. motors, de- on whether high tension (9,000 lb 00 lb) or low tension (0 to) is required. The control is by onard system, both motors being l with a generator. The selected is set by the coiler operator and atically maintained by a closed- mpensated current control, using e magnetic amplifiers. Coil speed mined by a tachometer fitted on stand of the 88 in. mill. The uxiliary controls are housed in l cabin local to the equipment. abin has been designed and ed to give the operator maximum for all operations.

Ventilation and Heating

For most of the factory area, heat losses from furnaces and machines provides all the heat input that is required for space heating, and concern is more with providing ventilation. However, the area in the 144 in. mill bay around the roll grinding machine requires constant air temperature to ensure a high degree of accuracy in operation. For this reason, it has space heating provided.

In many parts of the factory, static ventilators are suitable, but Brooks fan units are provided over the roll-coolant pump house, and exhauster fans are also used in the cold mill to assist static ventilators in the roof.

The building cladding of the main buildings is of electrical interest in that an interior thermally insulated wall lining is secured to the supporting rails largely by studwelding. This is claimed to be the first large-scale use of this technique in the UK. Crompton Parkinson welding guns were used.



Fig. 4. Some of the Solidal cable extensively used at Rogerstone, terminating at busbars in a switchgear installation

IMPROVED CRANE CONTROL

CLOSE SPEED MATCHING WITH LOAD

A SYSTEM of crane control claimed to give improved hoist performance has been devised by Mawdsley's. The "Mawdomatic" system, as it is known, is being used by Stothert and Pitt on their latest design of tubular dockside crane. The system is particularly suited to this type of application where rapid cargo handling is essential and where a light-hook to full-load speed ratio of up to 4:1 may be required.

An important advantage of the system is that simple, light control gear is used, so eliminating the heavy current switching often needed with d.c. series crane motors and with consequent reduction in contactor maintenance.

The system of control used is based on the conventional Ward-Leonard generator system, but close speed matching to load is obtained by incorporating a special exciter unit on the Ward-Leonard set. This exciter is claimed to control automatically, both the d.c. hoist motor and generator fields to

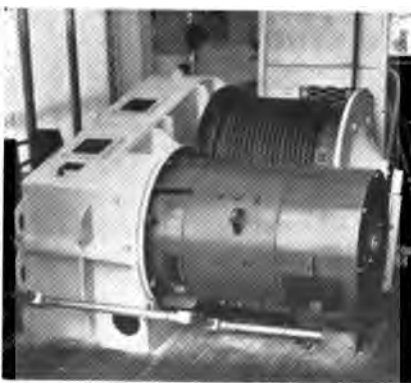


Fig. 1. Winch drive for dockside crane using the "Mawdomatic" control system

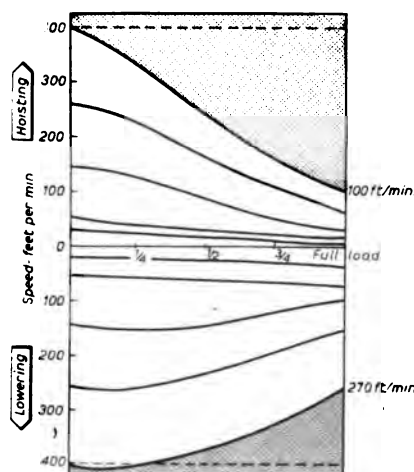


Fig. 2. "Mawdomatic" crane control. Contrasted load characteristics on hoist and lower for a series of no-load speeds

match the load torque required. The exciter is of special design and its output voltage is governed by the Ward-Leonard armature loop current. This system is claimed to give superior performance when compared with the conventional Ward-Leonard system, and to provide the operator with more sensitive control.

The system also has the advantages of avoiding maximum demand peaks, enabling regeneration to be used and permitting all hoist motors to be controlled by a single-handle joystick.

Even when the lowering speed is 66% of the light-hook speed, a drooping speed/load characteristic can be obtained which is quite stable. The system has so far been applied to crane drives rated up to 105 h.p.

Automatic gauge control for plate mill

PULSE SAMPLING SYSTEM REDUCES OFF-GAUGE OUTPUT

MENTION the words "electronic control" and one automatically gets an impression of something complex, expensive to install and liable to fail at just the moment when the only one who understands it is not at hand. Certainly the bought-out type of equipment is expensive and often over-complicated, largely because it has to be designed to suit a variety of different makes of machine. If, however, one possesses the necessary electrical know-how in the electronic sphere, it is possible to home-produce satisfactory apparatus which will give all the required accuracy for a particular application and machine without recourse to outside help and without necessarily being equally applicable to a similar machine in another place. Moreover, the cost is usually a fraction of the bought-out equivalent.

The Problem

At the Ebbw Vale Works of Richard Thomas and Baldwins Ltd. there arose the problem of eliminating production inaccuracies in the gauge of tinplate rolled on a five-stand mill.

A preliminary study of automatic gauge control systems manufactured by specialist firms soon showed that they were expensive and complex. Moreover, they were based on a scheme of rolling which differed from that in use at Ebbw

Vale. Even if authorisation for the expenditure were to be given, there was no guarantee that, in the event of breakdown, the mill would not be back to the unacceptable pre-system levels again. It had, however, already been accepted that the use of contact micrometers was out of date and an order had been placed for an X-ray thickness gauge.

The Instrumentation and Special Engineering Section of the Electrical Engineering Department at Ebbw Vale took up the challenge. They designed a gauge-sampling system using pulses to initiate correction of gauge and tension, the length of pulse being a measure of the degree of correction to be applied.

The Principle

Without entering too much into the technical details of the system, the basic principle can be understood from the schematic diagram in Fig. 1. Tension of the sheet between the adjacent stands is measured by a tensiometer and any variations from the prescribed value are converted into pulses which are amplified and then applied to the control of the screwdown motors. Similarly, the final thickness, as monitored by the X-ray thickness gauge, is checked to a prescribed value and any variations converted to pulses, amplified and applied to the control of the roll-motors.

In each case the length of individual correcting pulse is a function of the error signal in that the larger the error the longer is the duration of the correcting pulse. The preset space between adjacent impulses is the "sampling time" and the precessing of the screwdown motors or speed control regulator is, therefore, a series of impulses, equal in duration to the applied pulses and polarised in either direction.

An indicator (Fig. 2) tells the operator how rolling is proceeding and automatic adjustment takes place between the



Fig. 3. Operator at the control panel of the auto-gauge/tension control system

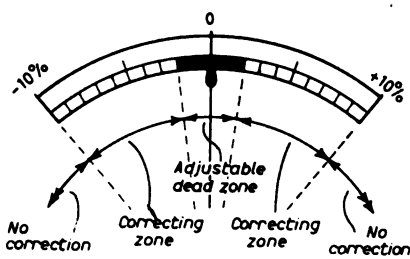


Fig. 2. Layout of X-ray gauge meter dial

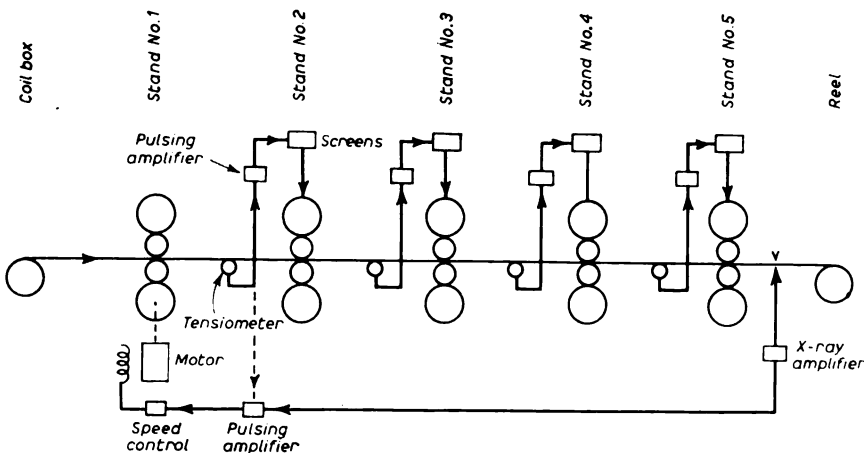


Fig. 1. Schematic arrangement of auto-gauge/tension control on a 5-stand tinplate rolling mill

ranges of $\pm 10\%$ except for a dead band of $\pm 2\%$ where no control is needed. Outside the 10% limits it is assumed that the mill set-up is faulty.

The sampling time can be adjusted to suit the rolling speed of the mill, but this is not an automatic operation since to make it so would unnecessarily complicate the circuit and the advantage gained are negligible. The only embellishments to the circuit are protective arrangements ensuring that the equipment automatically fails to safety.

The first stage, controlling the gauge by adjustment of the roll-motors, was completed in March of this year, less than four months after the first discussions. The subsequent developments on tension control have progressed in stages, one stand at a time, the first control having only just been completed.

Works Productivity Engineering Department reports show that, since the equipment was installed, the amount of off-gauge at the front end of the coil has been substantially reduced as well as off-gauge associated with welds. Further development work is in hand to simplify and transistorise the pulsing amplifiers with the idea of achieving a completely static control system. Work is also under way to apply the system to the four-stand cold-reduction mill.

Lighting in iron and steel works

ECONOMICS OF GOOD ILLUMINATION AND MAINTENANCE

ILLUMINATION of the working areas in iron and steel works presents special problems in that, for the most part, the height and length of the equipment—rolling mills, furnaces, etc.—necessitates the almost universal adoption of high-bay lighting. In addition, the high roof ambients, fumes and dust introduce a maintenance programme which, if not consistently carried out, can rapidly lower the overall level of illumination to inadequate values.

No one will disagree that all lighting must be good lighting for the conditions for which it is provided. The problem is to establish exactly what represents good lighting for particular environments. Lighting levels suitable for a furnace shop would, by any standard, be totally inadequate for a machine shop and it may conversely be argued that the levels for a machine shop are unnecessarily high for the furnace shop.

A number of published references can be consulted in relation to the lighting of steel and iron works and minimum standards are laid down by statute. These state that the general illumination over areas where persons are regularly employed shall not be less than 6 ft candles in a horizontal plane 3 ft above floor level or, in certain circumstances and where work is not actually being done, not less than 2 ft candles.

Both these figures must be taken as the absolute minimum and, in many cases, they are inadequate for the type of work being undertaken. It is left to

the lighting engineer to establish the absolute minimum for safety and efficient production in these and in other areas not bound by statute. How may a satisfactory standard be assessed?

The Vital Factors

If we exclude the obvious factors, such as enough lighting to see the job by, freedom from glare and eyestrain, there still remains other less obvious factors which are, however, quite as important. These include lighting for environment and safety; lighting to standards established by experience and practice; costs, both initial and running; maintenance.

In regard to lighting for environment and safety, it goes without saying that all lighting must be sufficient to ensure safe conditions for operatives. This is not merely a function of illumination levels alone; it includes the avoidance of dark corners, confusing shadows and sudden contrasts which may divert or distract the operatives' attention. There is also the psychological effect and its influence on production. The level at the working surface may be adequate for the job and an increase in illumination may not show a corresponding increase in quantity output. At the end of a long day, however, the extra lumens, by reducing fatigue, will have assisted in a better maintenance of quality.

Experience and Practice

In any iron or steel works there are still many buildings in which the lighting intensity is of the order of 1 or 2 lumens/sq ft. Output in these buildings has been carried on satisfactorily for years and production records broken with monotonous regularity. The most

plausible advocate of better lighting could not make a case on productivity alone, for records prove that the work can be carried on under such conditions. That is not, however, justification for retaining them; it may only be looked upon as a yardstick by which to judge the minimum level of lighting for that particular task.

Lighting is an amenity. The effect on an individual in passing from one part of a works to another must be borne in mind. The worker in the poorer lighted parts will always resent the conditions in a better illuminated shop, and with good reason. There is, however, no point in raising the standards above that necessary to preserve a degree of uniformity in lighting throughout the plant. Nor is there justification in raising the lighting level to those considered necessary for the drawing office and similar areas. Similarly, uniform lighting does not necessarily mean equality, for the melting shop does not need to be lit to quite the same intensity as a machine shop. The point is that it must appear to be so, which is quite a different matter. That is where the psychological approach comes in.

Cost

One of the most important factors is, of course, cost. But for this, all lighting schemes could be planned to simulate daylight conditions. It is fair to say that the best lighting scheme is a compromise between illumination and cost. The cheapest is not the most economic; the most expensive is not necessarily the best lighting. Many considerations enter into the picture not the least of which is the

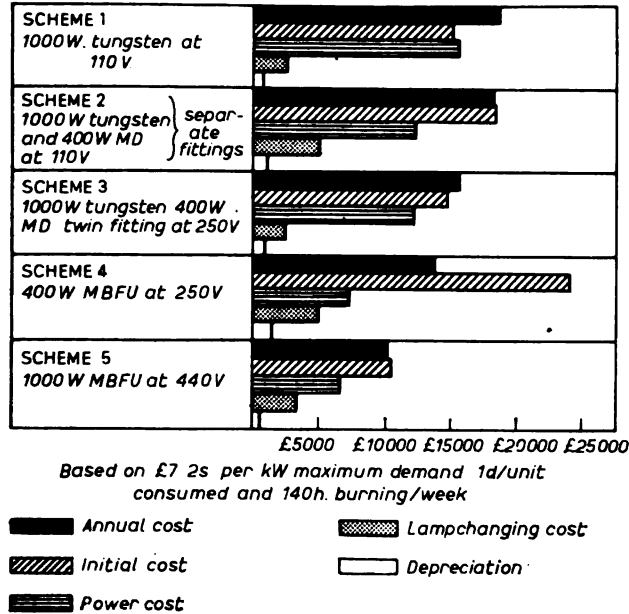


Fig. 1. Annual cost of selected installations showing constituent elements

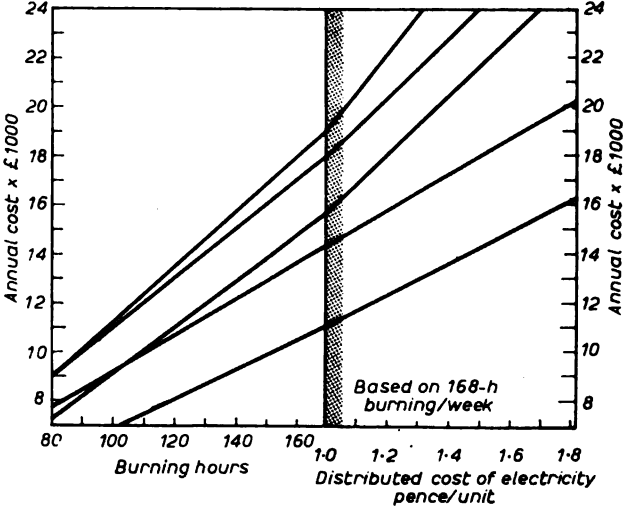


Fig. 2. Comparison of annual cost for different hours of burning and power cost. The graphs, in descending order, correspond to Schemes 1-5 in Fig. 1. The left-hand section is based on a distribution cost of 1d per unit; the right-hand section on 168 hours burning per week

effect on production. That good lighting can assist in output has been established time and again. It is not merely a simple matter of total lumens. The distribution, mounting height, choice of light source, voltage of supply, life of the lamps, frequency of cleaning and other factors all have to be taken into consideration, and an overall picture obtained before the lighting engineer—and the accountant—is satisfied that the best scheme has been adopted. Even then, some new development in light sources may change the picture in a few months' time.

Let us take, for example, an open-hearth melting shop and compare the costs for a number of different schemes of lighting on a basis of the same lumen output. This may not be strictly correct but it will be near enough for the five schemes which we shall consider.

The five are representative of the types of lighting mostly to be found in such workshops and in each case the costs have been estimated for initial cost, power consumption, lamp changing, including labour, and depreciation. In addition, the three latter items are summated to give an annual cost and the whole are presented schematically for comparison in Fig. 1.

Scheme 1 comprises 1 kW, 110 V tungsten filament lamps only; Scheme 2 is for 1 kW tungsten and 400 W mercury discharge lamps in separate fittings on a 110 V supply; Scheme 3 covers the same combination in twin fittings on a 250 V supply; Scheme 4 comprises 250 V, 400 W mercury fluorescent lamps and Scheme 5, 440 V, 1 kW mercury fluorescent lamps.

In the assessment, list prices of the fittings and lamps have been adopted while current costs are taken as 1d/unit plus £7 2s/kW maximum demand. The life of the fittings is assumed to be 15 years and that of the wiring 30 years. For maintenance purposes the burning hours per week are taken as 140 average with a life of 1,150 hr for tungsten filament lamps, 1,500 hr for the low-voltage mercury discharge lamps and 5,000 hr for the higher voltage types.

Fig. 2 shows the effects of variation in the number of burning hours per week and also the effects of increases in the cost of electricity running charges, on the basis of a 168 hr week, for each scheme.

From these two diagrams it is apparent that the item which most influences the annual cost is the power charge. A system with the lowest power consumption has a distinct advantage over others but this, in itself, is not the only factor to be considered.

Lighting Layout

A small number of high wattage lamps widely spaced apart might give an economical installation from the current aspect, but the general appearance of the lighting on the working plane would be "spotty" with alternating high and low level areas. Only in very high buildings are the heavier rated light sources economically applicable. For satisfactory distribution there is a minimum number

of fittings which must be used, the first step in compromise between lighting effect and cost. For example, the lamps listed in scheme 5 would only be suitable for high-bay lighting though the remaining schemes are wider in application.

The choice of light source is also bound up with colour discrimination. It has been said that uncorrected mercury-discharge lighting is quite acceptable for steel and iron works since there is little need for colour discrimination with the work in hand. This, however, avoids the important psychological effect of the sickly appearance it imparts to the complexions of those working in the area. A degree of colour-correction which is introduced by the internal phosphor coating of the mercury-fluorescent lamps makes them a preferable alternative, but both types of lamp have the disadvantage of taking some time to come up to full brilliance after switching on. Should the current be momentarily interrupted, a cooling period is also necessary which may mean an interval of five minutes or so before full lighting is again possible.

This may be overcome to some extent in schemes 2 and 3 by the presence of the tungsten filament supplementary lighting, providing only that it is separately switched. Against the advantages of good colour rendering and instantaneous lighting of the tungsten filament lamp has to be set the shorter life and higher current and replacement costs.

Lighting Intensity

While good lighting is essential, over-lighting is undesirable both from aesthetic and cost viewpoints. Excessively high values of lighting intensity are being called for in some steelworks and, in many cases, they could be halved without adverse effect on production or amenity. This, however, does presuppose good and consistent maintenance. Smoke and fumes condensed on the lamp envelopes and fitting reflectors, and dust deposited on the upper surfaces of the lamps, both of which are inescapable in steel and iron works, can rapidly reduce the light output by 50% or more. Extended maintenance may necessitate a higher initial lighting level to maintain efficient working levels at the end of each period but, economically, the capital and running costs of the higher level installation must be related to the maintenance costs. Unless it can be shown that the saving in maintenance charges is greater than the additional running and depreciation cost brought about by the adoption of the higher level, it is obviously uneconomic to adopt it.

In any case, maintenance, which includes cleaning and lamp replacement, cannot be extended beyond intervals set by the life of the lamp. The life of a tungsten filament lamp necessitates changing once every six or seven weeks which represents the maximum period for reflector cleaning. With gas discharge lamps several cleanings are essential in the course of its normal lifetime. Unless

special access arrangements enable the fittings to be seen, work is in progress, the process of the cleaning and replacement must be carefully organised and tentatively carried out.

In a small factory or mill considered that the task of not large enough to fully attention of a single man therefore, be given additional facilities.

Should these interrupt the programme, it may fall behind, with dire effect to lighting.

Nor is it economical to wait to burn out before replacing. The cost of the lamp may be labour cost of breaking the man's routine, fetching the replacement, ladder and, putting work in the area may outweighs the lamp cost an treble or quadruple it. In a small plant, it is an economic gain cleaning and replacement which ensure the routine lamps before they have reached their life and at a convenient time to coincide with cleaning rota; in large factories economic necessity.

Good lighting is an expense which though a necessary one that proper attention maintenance, however, it is a cost which pays high dividends only in steel and iron works every factory and office area dirty atmospheres of the heavy working industries, however, maintenance assumes its greatest

Fluorescent Lighting

No mention has been made of fluorescent lighting using the fluorescent tubes. This is not because of any shortcomings in the tubes, but rather because they have been generally considered as high-bay lighting in such cases.

The low watt loading of the units available, necessitates a large number of fittings in high-bay installations, over, high ambient temperatures in furnace roof levels may affect the control gear unless special measures are taken to protect it. The greater as compared with tungsten lighting and the longer starting and restarting as compared with the mercury and mercury lamps make them an ideal for every other ground. The use of the 8 ft 125 W twin arm fittings may give rise to a saving of their value in high-bay lighting the future. In regard to lighting and taking average through a three-tube fitting using tubes would give some 20% output as compared with a 400 W mercury fluorescent fittings, taking under 800 compare with a 1 kW, 440 fluorescent lamp.

Fuel element shapes

NUCLEAR POWER REACTOR DESIGN FACTORS

ONE of the fundamental decisions that has to be taken in design of a nuclear reactor concerns the fuel element cans; in what material shall they be made, and of what shape? Directly involved in that decision is the effectiveness of heat transfer that can be achieved from the can surface to the coolant gas, by using projections on "extended surfaces." This aspect of heat transfer was considered extensively at a symposium* organised last week by the Institution of Mechanical Engineers. The factors applying were reviewed in a paper by Mr H. H. Gott (Nuclear Plant Design Engineer, GB) and others, with which this summary is mainly concerned.

Materials Factors

In designing a reactor, there are four interrelated factors, determined by properties of the materials used, which stand out in importance. They are:

- (1) The maximum allowable temperature of the fuel element.
 - (2) The maximum allowable temperature of the uranium fuel.
 - (3) The maximum allowable temperature of the coolant.
 - (4) The deterioration of nuclear characteristics with increasing quantity of canning materials.
- Assuming a magnesium alloy can is used, then (1) is concerned with strength and perhaps rate of evaporation of the can.

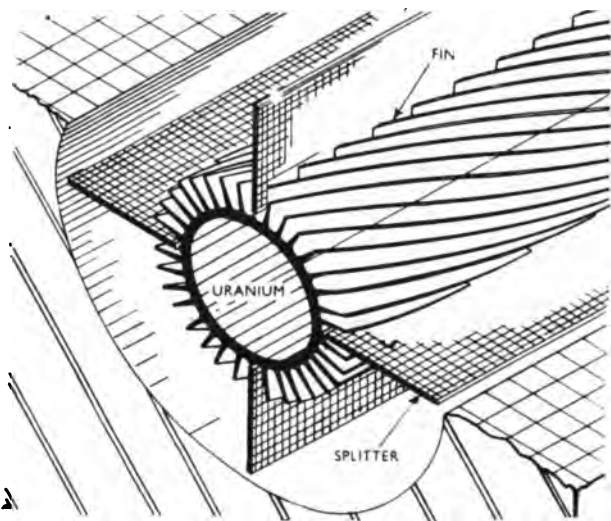
Magnesium alloys, although decisively attractive from a nuclear aspect, have many disadvantages, including poor high-temperature mechanical properties, which limit temperature and exercise a big effect on the efficiency of the associated steam cycle.

Outline figures for the design of a power reactor to give 850 MW net electrical output serve to indicate the background to decisions about fuel elements. About 850 MW output will be required from the nuclear fuel. Allowable temperature rise of the gas coolant will be about 100°C, so mass flow of gas will be about 8,600 lb/sec, distributed amongst perhaps 3,500 cooling channels in a graphite core. This gives a mass flow of about 2.5 lb/sec/channel on average. The total power required from gas circulators is 25 MW.

In practical reactor system design, such overall figures must be arranged in detail so as to "optimise" the reactor design; in the UK, in terms of lowest total cost per unit of power delivered over the design life of the plant. Quite large variations in thermal rating are possible for a reactor

core having a fixed maximum fuel can surface temperature. Broadly speaking, there can be two types of change. The inlet temperature of the gas can be varied with the coolant mass flow held constant; or the coolant mass flow can be varied with the inlet gas temperature held constant. The effects are broadly as follows:

- (1) Holding the mass flow constant and raising the coolant inlet temperature will lower the thermal output and will increase the pumping power, but it will increase the exit gas temperature considerably, with consequent benefit to the steam cycle efficiency.



Typical fuel element for CEB reactor in its channel (after A. F. E. Wise)

- (2) Keeping the coolant inlet temperature constant and increasing the mass flow will raise the thermal output and will markedly increase the pumping power, and it will lower the gas exit temperature and thus the steam cycle efficiency.

To take advantage of (1) implies lower fuel costs, higher capital costs; (2) reduces capital cost at the expense of fuel cost.

Extended Surfaces

Configuration of fuel can surfaces enters into calculations in terms of pumping power, through resistance to gas flow, as well as through setting a maximum to heat output per element, through heat transfer considerations. The addition to pumping power necessitated by the drag introduced by extended surfaces is more than offset by the "spectacular" gains in channel heat rating compared with plain surfaces.

On the whole, more thin fins are the form of extended surface preferred with a permissible mass of canning material per unit length of fuel channel. However, it has to be borne in mind that the thinner the fin the less its efficiency, because the conduction temperature gradient along the fin will be comparatively high.

The solution arrived at by the various nuclear consortia involved in the nuclear power stations being constructed

The symposium was entitled "The Use of Secondary Media for Heat Transfer with Clean Gases." The paper presented in the present article is "A General Survey of Influence of Heat Transfer on the Performance of Gas-cooled Power Reactors," by H. H. Gott, M.A., M.I.MECH.E., London, M.A., and J. P. Bond, B.SC.(ENG.), G.I.MECH.E., all of the CEB.

for electricity supply in the UK is helical finning in conjunction with axial longitudinal fins to break up the flow into distinct axial troughs; or what is very similar in effect, longitudinal finning with helical splitters. Optimum number of splitters is about four. Interaction between fins and splitters sets up a vortex motion that gives a good interchange of gas between the inter-fin and free-flow spaces. Design is largely experimental, and apparently superficial differences can produce an effect on heat transfer performance that the authors note as "surprising."

An example of the results that those concerned with fuel element development still find unexpected is that the sharp edges left on machined fins lead to heat transfer significantly improved in comparison with that obtained with extruded finning of the same nominal dimensions.

Away from heat transfer considerations, thought has to be given in fuel element can design to what will happen to the lowest fuel elements in a stack when those above them are removed. There is a risk that the rush of coolant will blow them bodily out of the reactor core. If this happened there would be some risk of damage, and a more serious possibility that it might be difficult to remove the elements concerned. In some reactor designs, self-weight of the fuel elements is kept high enough to prevent this happening, in others special structural arrangements are made.

Extended surfaces are used in nuclear power stations, not only on the fuel element cans but also on the heat exchanger tubes. Here, their use is forced by economics; the nuclear station heat exchangers have to be compact

compared with ordinary boilers because of the high cost of the pressure shell, and they have to work with a smaller temperature difference. The technique used is to weld on continuous close-coiled helical strip or studs, and plates of various configurations. Once again, a careful optimisation investigation is required to balance advantages against such contrary factors as gas-side pressure loss and increased capital cost caused by use of extended surfaces.

Future Developments

Looking to the future, the authors suggest two possible developments not yet included in any of the CEBG reactors; but they warn that increases in rating which remain possible in magnesium alloy fuel elements are not very large.

The first of the suggestions is for use of channels in the graphite core whose cross-sectional area varies along the length so that flow velocity is everywhere approximately matched to local rate of heat release. This allows some fuel elements which would otherwise run rather cool to be operated with a surface temperature far nearer the designed value. The channels in the core would presumably be stepped as a means of varying the diameter, and this would introduce an increased risk of fuel elements jamming.

The other idea is to use fuel elements with increased fin tip diameter, with the root diameter increased also, so as to obtain improved fin efficiency. This is likely to necessitate use of hollow uranium fuel rods to avoid excessive temperatures at the centre of the uranium.

Sensitive Earth-fault Relay

INCREASING demand for refinements in relay technology are illustrated by two recently developed relays shown by English Electric at their meter and relay exhibition held recently in London.

High Resistance Earth Fault

The first relay is intended to trip circuit-breakers should a high resistance earth fault occur on 11 kV or 33 kV rural distribution lines. The relay has a minimum setting of 0.1 A corresponding to 2% of normal full load when a 5 A c.t. is used. The unit incorporates an adjustable timer to ensure that the main earth fault protection system has time to operate.

The unit, type CMU, consists of a sensitive polarised relay, fed from existing protection current transformers through a rectifier and saturable auxiliary c.t. By using a polarised relay, good mechanical stability is obtained with a relatively small operating differential. The object of the saturable c.t. is to limit current flowing through the polarised relay on overload. It enables the relay to be rated for overloads of 100 A for 10 sec to 200 A for 2½ sec. Since the burden of the c.t. is only 0.005 VA, it imposes practically no extra burden on an existing protection installation.

Two types of the relay are available for either self- or hand-reset, with

contacts rated for 1,250 W and with either 5 A or 660 V d.c. maximum.

Single Shot Auto-reclose

An auto-reclosure scheme was also displayed. This scheme uses standard relays to provide a limited number of circuit-breaker operations before locking out. If a fault occurs on a system, the "single shot auto-reclose" scheme allows a single reclosure. If the fault is transient and the line is again healthy, the scheme resets in readiness for the next operation. If, however, the fault persists, the scheme locks out the breaker after the second clearance. The scheme includes a counting relay which can be arranged to lock-out the breaker after a predetermined number of fault operations between one and ten, and which can also be used to give indication that maintenance on the breaker is required. A timer unit allows reclosure with a dead time adjustable between 5 sec and 30 sec and a reclaim time up to 30 sec.

This scheme is applicable to both motor-wound, spring-operated and solenoid-operated circuit-breakers.

The exhibition, which is visiting various centres, also contains several products of the company's progressive instrument division. The insulated case instruments were extended in the past year to include moving iron meters. Features of other meters were a move-

ment which can be removed without loss of sensitivity for maintenance and moving iron instrument with expanded lower scale reading giving accurate reading from 5% to 20% f.s.d.; development intended for application where future load growth is anticipated.



The English Electric relay type CMU will detect high resistance earth faults on 11 and 33 kV distribution lines. Overcurrent protection is included

Electricity in aircraft

I.E.E. AND R.Ae.S. JOIN FORCES IN SERIES OF DISCUSSIONS

THE tremendous growth in electrical equipment and services on military and civil aircraft in post-war years has imposed a considerable strain on the aircraft industry. Electricity is no longer a subsidiary and relatively unimportant part of an aircraft's power system; it is a vital contribution to aircraft safety, navigation and control without which no airliner, fighter or bomber could fly today. In Britain the aircraft industry has, for far too long, ploughed its own lonely field in developing the systems and equipment, depending largely on the experience of component manufacturers—many of whom have themselves grown up in the low voltage automobile industry—and on imported experience and equipment from the USA.

Until a few years ago there was a tendency to look down on electrical engineers who were engaged on the work of catering for the aircraft's needs as being of small account. In the industry they were often on the chief draughtsman's staff with little authority of their own; in the wider profession their position and experience was, of itself, not considered sufficient qualification for corporate membership of the IEE. In America, though, the electrical side of the industry had already justified the formation of a special body within the AIEE.

By 1955 there had grown an awareness of the responsibility which such engineers were shouldering, the amazing breadth of specialised knowledge in d.c. and a.c. technology and in electronics which they had to possess and the peculiar environmental conditions which coloured each and every one of their problems. In May, 1956, the first joint get-together of the two institutions, the Royal Aeronautical Society and the IEE, took the form of a symposium held in London at which it became clear that, in the future, there would have to be closer co-operation between the two professions if the best solutions to the ever increasing electrical problems were to be attained without excessive dependence on American practice.

The second step, logically an extension of the discussions which had continued between the two bodies since that first symposium, opened last Friday with a joint meeting at the IEE at which both the president of the IEE, Sir Hamish D. MacLaren, K.B.E., C.B., and of the Royal Aeronautical Society, Dr E. S. Moulton, C.B.E., B.Sc., M.I.MECH.E., were present. In a well filled assembly, Viscount Caldecote, D.S.C., M.A., M.I.E.E., presented a lecture which was intended as an introduction to a series of joint discussions on future trends in airborne electrical and electronic equipment.

Present and Future Trends

In a summary lasting just over an hour, Lord Caldecote touched briefly on every aspect of electrical service in aircraft and guided missile engineering with position to date and the problems to be faced as speeds, in the case of manned aircraft, passed Mach 1, approached Mach 2 and even Mach 3. Cables, already being upgraded for higher temperatures with silicone and p.t.f.e. insulation, might have to be mineral insulated. Generator drives would depend upon the choice of system, 28 V d.c. remaining

for smaller range civil airliners and private aircraft, but changing over to 220 V a.c. on larger, long-range machines. Whether it would be constant or variable frequency would depend both on the application and future technological developments. Frequency-wild systems were adequate for heating and de-icing circuits and, by the use of semiconductor rectifiers and batteries, could also be applied to relay operation and motorised services. They did not need comparatively heavy constant speed drives which, however, were not yet at the end of their development.

Constant frequency systems had enjoyed a vogue in recent years and could be operated either as separate or paralleled systems. Their value lies in that the many motorised applications could be carried out with brushless motors so avoiding brush problems at high altitudes and, in addition, constant frequency was required for many electronic devices. The development of the semiconductor inverter might, however, change the position in that constant frequency supply might be attainable at less weight from a rectified d.c. source.

The development of many electronic devices on missiles had contributed much to both manned and unmanned vehicles. In the civil and military aircraft fields weight was an ever present problem. The space limitations in missile development had resulted in micro-miniaturisation techniques which would be invaluable in aircraft. The higher speeds of aircraft introduced problems of navigation and collision risks which necessitated speeds of decision and action rapidly approaching the limits of the human being. Electronic control and computer devices are essential to the future of high speed transport. In a survey of navigational systems he mentioned the conflicting claims for the VOR/DMET and Decca systems.

Touching on the direct generation of power, there were the possibilities latent in current developments of gas or nuclear heated thermoelectric cells, fuel cells and allied devices. Without looking too far into the future the number of immediate problems to be solved, all of which must have the inherent quality of reliability, necessitated close co-operation not only within Britain but throughout the Western world or we should not be able to maintain our competitive position against Russia and her satellites.

DISCUSSION

In the discussion which followed, many prominent members of both institutions took part. MR C. G. A. WOODFORD opened by taking up the speaker's final words. We would all like to know what Russia was doing in this field. She has obviously made astounding progress. On the subject of computers, was there not an element of vulnerability in the multi-wiring systems? SIR GEORGE EDWARDS, managing director of Vickers-Armstrongs (Aircraft), emphasised the essential quality of reliability in all aircraft electrical equipment. DR WILSON referred to the failure rate for missiles and said that this was too high for aircraft. MR H. ZEFFERT stressed the importance of co-ordination between electrical and mechanical engineers in the design stage. Electrical equipment was only as reliable as the associated mechanical devices. Others contributed and LORD CALDECOTE briefly replied.

equipment for industry

Nylon cable glands

BY increasing the length of the body screw to $\frac{1}{4}$ in. the range of application of "Elkay" nylon cable glands has been extended to accommodate up to $\frac{1}{4}$ in. thick plate. These are made up of four parts: rubber gland, metal washer, body and gland-clamping bush, the latter components being moulded in shock-resisting nylon compound. Available in black or white, sizes range from $\frac{1}{4}$ in. dia to $1\frac{1}{4}$ in. dia. Nylon locknuts can be supplied if required. In the same range are polyethylene insulating bushes for cable diameters up to $9/32$ in. *Elkay Electrical Mfg. Co. Ltd., 42 Woburn Pl, W.C.1.*

Closed-circuit TV equipment

A CLOSED-CIRCUIT television installation costing £335 consists of a camera unit incorporating the power supply. The camera uses a Vidicon pick-up tube having a resolution equivalent to 2.5 Mc/s on the 405-line system. The standard f1.9 lens supplied has a 28° horizontal angle, but wide-angle and telephoto lenses are available if required. The camera is claimed to be suitable for use in conjunction with the majority of 405-line commercial receivers acting as monitor. *Nash and Thompson Ltd., Oakcroft Rd, Chessington, Surrey.*

Governor-controlled motors

OF particular note among a range of precision components for aircraft and other instrumentation systems are a.c.- and d.c.-governed motors. The a.c. motor is a three-phase induction type with wound rotor having a nominal speed of 1,500 r.p.m. at 50 c/s, 230 V, with an output of 20 W. Speed is held constant against supply and load fluctuations by centrifugal governor-operating contacts in the rotor circuit. Thus, a supply voltage variation of 13% causes only a 0.3% speed change, and a 12% load change affects speed by 0.2%. Manual speed control of ± 100 r.p.m. is effected by mechanical adjustment of the magnetic circuit. A suitable application for the motor is in high fidelity magnetic recorders. The d.c. motor is available for 12 V and 24 V supplies and has an output of 6 W at 3,000 r.p.m. Speed regulation of 14% is maintained for a load fluctuation of 40% of full load, and 24% regulation for supply voltage variation of 40%.

Various additions and amendments have been announced for the range of

components mentioned which includes such devices as acceleration inductance transducers, pressure switches and capsules, and synchronous torque transmitters. *Kelvin and Hughes Ltd., New North Rd, Barkingside, Essex.*

Remote dial indicator

UTILISING the a.c. synchronous torque transmission principle, a remote dial indicator unit registers angular or linear readings received from a corresponding transmitter at the source of information. The standard model has a 3 in. dial calibrated from 0° to 360° , and reads to an accuracy of $\pm 1^\circ$. A square flange is provided for panel mounting and alternative calibrations can be supplied to suit individual requirements. Models are available for either 50/60 or 400 c/s transmission frequency. *Ketay Ltd., Eddes Hse, Eastern Av. West, Romford, Essex.*

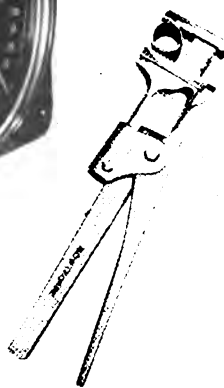
Multi-purpose wrench

A MULTI-PURPOSE tool which should find wide application in electrical assembly and maintenance work, combines the functions of a spanner, pipe-wrench and wire cutter. 12 in. long and weighing $2\frac{1}{2}$ lb, it will accommodate nut sizes up to 2 in. and cut $\frac{1}{4}$ in. diameter wire. Of chrome-vanadium steel, the tool is said to give hard-wearing service. *Bowthorpe Electric Co. Ltd, Crawley, Sussex.*



◀ Ketay remote dial indicator registers angular displacement from $0-360^\circ$

▶ Multipurpose tool can be used as a spanner, pipe wrench or wire cutter. Distributed by Bowthorpe Electric Co. Ltd.



▶ Square "D" illuminated push-button

Miniature electrolytic capacitor

A RECENTLY introduced range of miniature electrolytic capacitors are of etched foil construction and contained in an aluminium can $\frac{1}{4}$ in. long by $\frac{1}{4}$ in. diameter. They are designed specifically to give low impedance at frequencies of 10 kc/s and above; they also offer internal resistance of less than 0.2 ohm. They are thus claimed to be of particular use in transistorised computer circuits dealing with pulses in the order of a microsecond duration. Capacitances range from $200\mu\text{F}$ at 3 V to $12\mu\text{F}$ at 150 V. Maximum working temperature is 40°C while best power factors are obtained at -40°C , a typical value being 0.5 for the $40\mu\text{F}$ 25 V rating at the latter temperature. *The Plessey Co. Ltd, Ilford, Essex.*

Magnetostriction delay line

DELAY lines in which a mechanical pulse, magnetostrictively induced, is transmitted along a wire have been used in computers and allied devices for several years as storage and time delay elements. Now it has been possible to develop a device as a standard unit which can be incorporated in a line to give variable delays between 2 microsec and 10 millisecc with a digit rate of up to 500 kc/s and fluctuation in delay time of under 1 millimicrosec.

The device comprises a magnetostrictive element and a transmission line, the effective length of which is adjustable through a low torque, recirculating ball race drive. Manual or servo operation can be applied and micro-limit switches are fitted. *Ferranti Ltd., Hollinwood, Lancs.*

Illuminated push-button

FOR use in conjunction with heavy-duty contactor control gear, an illuminated push-button unit incorporates its own miniature transformer for supplying the 6 to 8 V pilot lamp. Operation of the push-button closes a pair of contacts. One, rated at 6 A, is for controlling the external contactor circuit, the other for the internal lamp circuit. With this arrangement the pilot lamp remains alight only when the button is held depressed; however, by suitable interconnection it can be made to indicate whether the external circuit is open or closed. The push-button lamp lens is available in four colours in addition to clear and opal white. Supply voltages catered for range from 110 V to 600 V a.c. *Square "D" Ltd, Cheney Manor, Swindon, Wilts.*



for the electrical trade

Freeze 'fridges

There is no uncertainty over the "p freeze" claim by Kelvinator "Zero-plus" freezing compartment—this new fixture—a standard in its range—maintains a temperature between zero and 5°F, a level meets with the satisfaction of ice-cream and frozen-food producers. Furthermore, the remainder of the refrigerator equipped with "Zero-plus" remains at approximately safe temperature for foods like vegetables.

The new model is the highlight of the range, the "Lady K" 3.1 cu ft in addition to the freezing compartment, this model features three shelves, interior lighting, separate compartment and magnetic door. It requires a modest floor in. by 19 in. and can be wall-built-in, or freestanding. A mounting kit will be supplied at any time after purchase. The remainder of the range retains last prices, though all models now have the new freezer. Compressed-guaranteed for five years. Price of "Lady K" is £52 10s, tax included. Kelvinator Ltd., Gt. West Rd., W.4.

Light source

There is the possibility of electroluminescence for domestic illumination aroused in America recently being used in two panel night-light. The main advantage of the new light is its low—if not negligible—

current consumption. Now, a switch, or socket-outlet locator, which employs the principle has appeared in MK's new accessories catalogue, and it is probably its first domestic application in this country.

The locator is a mounting panel, which takes any fixture having 2½ in. fixing centres. It emits a green glow sufficient to silhouette the switch or socket. The panel comprises the 3½ in. by 3½ in. illuminating surface, enclosed in a transparent frame, with connecting leads and resistor. The locator appears white during daylight, adding a decorative touch as well as an incidental protection against finger-marks on the wall. Price is 5s 8d list. M.K. Electric, Shrubbery Rd, N.9.

New lamps need no shade

A COMPLETE breakaway from the familiar style of domestic tungsten lamp is shown in the new 60 W "Fantasie" model, designed for installation without a shade. It is large for a domestic lamp—about 9 in. long—and so far is available in two shapes, one



Philips' new "Fantasie" lamps fulfil the functions of decorative fittings and need no shades. Price 12s 6d, tax paid



Latest Kelvinator 'fridge. It has a "Zero-plus" freezing compartment



long and smooth, the other slightly angular. Surface is opaque "Argenta" white. The gold anodised cap extends 2 in. over the envelope, imitating a semi-decorative lamp holder. The new lamp, recommended for installation in bedrooms or hall-ways is, in fact, its own decorative fitting. Price 12s 6d, tax paid. Philips Electrical, Century Hse, Shaftesbury Ave, W.C.2.

Panels for skirting heating

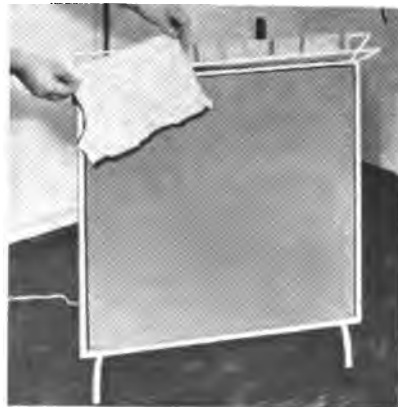
SKIRTING heating is the latest application of "Morheat" low rate warming panels. These panels, which are being used in an increasing variety of products, comprise "Mhoglass" non-metallic mesh-type elements sandwiched between boards of Swedish Masonite. The skirting sections are panels 4 ft long by 8 in. high, mounted in capping boards. They are easily fixed with metal brackets supplied. Rating is 200 W per section; price, £5 5s.

New "Iced-Diamond"

A NEW 53 gn version of Hotpoint's "Iced-Diamond" 3.7 cu ft refrigerator is being delivered to the trade this week. The main difference between this ES37 model and the existing E37 Super is that the new model has no kick-strip, interior light, rollers, butter dish or salad bin, and is available only with a right-hand hinged door. It is available in white or cream cabinet with white polystyrene liner. AEI-Hotpoint, 33 Grosvenor Pl, SW1.

New commercial tube fitting

AN entirely new range of fluorescent fittings for commercial and industrial use are introduced under the name "Streamlite." They feature extremely light and slim channels, hardly deeper than the tubes themselves. The 5 ft 80 W models are available for one, two or three lamps and the 2 ft and 4 ft with one or two. They can be supplied with switch-start or switchless start apparatus and all are suitable for single or continuous mounting. A wide range of diffusers and reflectors is available. Philips Electrical, Century Hse, Shaftesbury Ave, W.C.2.



Above: The "Morheat" drying panel—a further application of the "Mhoglass" heating element, £9 9s. Left: Skirting sections of Morheat boards are easily installed and sell at £5 5s tax paid

Lights for Christmas

DESIGNED for the smaller Christmas tree favoured in most homes, the new "Lilliput" sets of fairy lights sell at £1 9s for 20. They consist of small jewel bulbs coloured blue, green, red, yellow and white, set in small rosettes at 9 in. intervals along the flex. These lights, which need not, of course, be confined to a tree are said to be long-lasting, safe and easy to replace. The failure of one does not extinguish the whole set. An attractive packing has been designed for point-of-sale appeal—the lights are clustered so that they project from the apex of a gaily coloured cardboard pyramid. This mount fits within an attractive outer container. The set of 40 bulbs is available at £2 9s 6d. Another Christmas idea is a 22 in. high tree fitted with 20 bulb candles. It sells at £1 18s 10d. All prices include tax. *The General Electric Co., Osram Lamp Divn. Magnet Hse, Kingsway, W.C.2.*

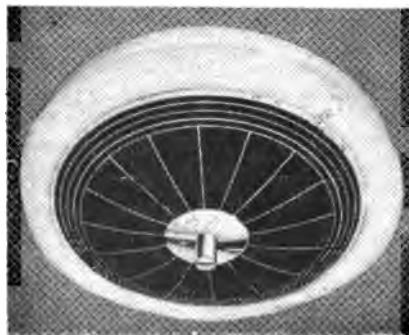
Circular fluorescent fitting

EFFECTIVE use is made of the circular fluorescent tube in a domestic ceiling fitting, "Ringway." The tube remains unobscured, but the circle it forms is filled by a shallow glass bowl of black, yellow or red. A chromium-plated bush secures this centre-piece and is easily unscrewed to provide access to fixing holes and control gear. "Ringway"

MARRYAT-SCOTT.—24-page coloured brochure on lifts, escalators and paternosters by Marryat-Scott Ltd., Wellington Wks, Hounslow.

E.E.—28-page technical booklet on E.702 Storage Tubes. English Electric Valve Co., Chelmsford.

LUCAS.—Pamphlet on a 12 volt alternator set for cars and commercial vehicles. Birmingham.



The novel "Ringway" fluorescent tube fitting up to £4 17s 6d

may be flush-mounted, but provision is also made for chain suspension. There are three models priced as follows: 8½ in. dia, 22 W, £3 19s 6d; 12 in. dia, 30 W, £4 7s 6d; 16 in. dia, 40 W, £4 17s 6d. *Hounslow Heath Electrical, 375 Staines Rd, Hounslow, Middx.*

TRADE PUBLICATIONS

VACTRIC.—Broadsheets on following units, giving detailed technical information: 08 a.c. motor; 10, 15 and 08 a.c. motor tachogenerator; 11 a.c. induction motors; 11 a.c. temperature compensated motor tachogenerator; 07 d.c. motor; 11 and 15 d.c. split-field motors; 11 d.c. tachogenerator. Vactric (Control Equipment), Vactric Hse, Sloane St, S.W.1.

T.I.—Brochure describing a wide variety of extended surface tubes by subsidiary companies of Tube Investments Ltd., The Adelphi, W.C.2.

ATLAS.—Booklet on flash photography. "Get the best results with Tru-flash," 27 pp. Atlas Lighting Ltd., Thorn Hse, Upper St. Martin's La, W.C.2.

OSMOND.—Pamphlet illustrating a representative range of cut-off machines and pamphlet describing in detail Model O/10. A. and S. Osmond, 13 Dowry Sq, Bristol 8.

LESSER.—Leaflet: "Progress in Prefabrication 6"—cedar cladding: red cedar exteriors. J. E. Lesser and Sons, Green La, Hounslow, Middx.

KELVINATOR.—12-page booklet with cartoon illustrations entitled "How to Choose a Refrigerator." It gives details of their "Zero-plus" freezing compartment in the new range. Kelvinator, Chiswick Flyover, Gt. West Rd, W.4.

ERICSSON.—Technical pamphlet on Micro-signal Chopper Type D. Ericsson Telephones Ltd., Electromechanical Division, Beeston, Nottingham.

S.T.C.—News Bulletin Vol. 7, No. 1, October, 1960. Standard Telephones and Cables Ltd., Connaught Hse, Aldwych, W.C.2.

Improved Lighting at Liverpool Street

ON the eve of inauguration of London's recently electrified north-eastern suburban railway, an entirely new lighting scheme for Liverpool Street station has just been completed. Results have been dramatic; illumination has been increased five-fold from the dingy 1 lumen/sq ft provided by the original soot-covered tungsten-filament spherical fittings. Improvement of lighting amenities for this station was long overdue. Also, adequate illumination would increase passenger handling efficiency

demanding by the expected rise in traffic on electrified lines. Electrification would itself ameliorate the problem by the consequent reduction in light-absorbing smoke haze; in fact, required illumination has been obtained with only 40% additional power consumption.

Harmony with the architecture of the existing station structure was one of the aims in designing the new lighting scheme. This, it was felt, could be best achieved by placing lighting fittings as high as possible to avoid the oppressive

effect of an unlit roof-space. Colour-corrected high-pressure mercury discharge lamps were chosen for the main overhead lighting. Besides being economical in power consumption, their long life would reduce maintenance costs. Plain mercury vapour and sodium discharge lamps were not acceptable because of poor colour rendering and the possibility of confusion with track signal lights.

The lamp fittings, mounted in dispersive reflectors, are chain-suspended from hinged access hatches which replace the original roof-light panels. They are spaced at 60ft to 70 ft intervals, mounting height being 60 ft to 65 ft. Wiring runs along the top of the station roof, connections to individual fittings being via 5 A. three-pin plugs and flexible leads from cast-iron control boxes introduced into the main conduit runs.

The provision of subsidiary lighting, such as for ticket barriers and parcel concentration areas, is achieved by cold-cathode linear discharge lamps. These also illuminate open platforms where they are mounted at 11 ft 6 in. on specially designed concrete columns.

Station lighting control is effected by two three-phase 30 A contactors housed in the main power supply circuit-breaker cubicles. The contactors are remotely operated from two points in the station building. Should there be a failure of the main supply, there is arrangement for switching in the London Transport Executive's 33½ c/s supply.



New lighting at Liverpool Street station. Colour-corrected mercury vapour lamps mounted high overhead emphasise cathedral-arch effect of roof supports

Inspection Council progress

N.I.C.E.I.C. PRAISED BY HOME OFFICE MINISTER

TRIBUTE to the work of the National Inspection Council was paid by Mr D. Renton, Q.C., M.P. (Under-Secretary, Home Office), speaking at the luncheon which followed the Annual General Meeting of NICEIC. Mr Renton said the Home Office had a national responsibility in connection with public safety, from this aspect was most interested in the work of the National Inspection Council. The Council was based on voluntary co-operation with no statutory backing, yet it played a vital part to play with respect to public life. Its statutory nature did not mean it was less appreciated in government circles.

Mr Renton suggested that the success of the NIC rested on three pillars: the electricity boards, the ECA, who had been helped by advising members to enrol, and the IEE, who had made a readily recognised standard which the NIC could recommend for wiring installations.

The time was right for the NIC to extend its efforts further and attract the interest of the public more widely. More than 20,000 copies of the roll of the NIC had been issued. This was almost Penguin numbers, and he was glad that it satisfied the test of the public good. It was a good thing to get public authorities to set an example in matters such as employing only approved contractors; if public authorities did so, others would be encouraged to do the same.

Mr Renton noted that 1959 was the worst year in the country's history so far as fire losses were concerned. A large number of fires were caused by faults in electrical installations. The Home Office was most anxious that the best possible use should be made of lessons learned from these fires. In some cases there was a fault in the use of electricity which could have been overcome by care in installations.

The reply to Mr Renton was made by NIC chairman C. T. Melling (Electricity Council). He noted that the Council had appointed an additional inspecting engineer in an attempt to improve regularity of inspection of established contractors. Work was compared with the IEE regulations in their full demands. Some 27,000 inspections had been made to check that work of enrolled contractors was of high quality. However, there were many contractors not enrolled. The Council was doing its best to attract new members to its membership. It was in their interests to become enrolled, because more and more local authorities were requiring membership before placing contracts.

On the subject of fires, Mr Melling said the NIC was well aware of the trouble caused by bad electrical installations. In this respect not only the quality of the installation was important, but its comprehensiveness. The electrical demand doubled every 10 years, the number of accidents could increase still faster. In order to be sure that all types of accidents were reduced the Council was working on an increase in number of socket-outlets in rooms so that the electrical installations could have "flexibility built in."

The annual report of the NIC showed an income of £169 during the year ended 31 March, 1960. Salaries

and related expenses took £31,070, travelling and general expenses £13,400. At the end of the year there were 3,694 contractors (including area boards) on the roll, at 5,310 operating addresses.

PACKAGED SWITCHGEAR

CLAIMED to occupy little more space than a conventional indoor installation, the "Weatherbeater" packaged switch station now being marketed by English Electric Co. houses 33 kV switchgear. Unpainted aluminium is used for cladding and only a simple concrete raft foundation is needed for the switchgear. Built from standard units, each 16 ft 9 in. high by 12 ft 3 in. deep, a switching station can be assembled to give the required switch arrangement.

Each building unit houses either an EE Co. single-tank oil-circuit breaker for 1,200 A or for 2,000 A. Single busbar, for 750 MVA and 1,000 MVA short-circuit ratings, is the arrangement available. Isolation is by means of hand-operated isolators on both sides of the circuit-breaker. Built-in cable equipment is provided, together with busbar earthing equipment where appropriate.

The packaged station has all the interlocks usually provided with metal-clad gear. Isolators, earthing equipment and shutters are all operated from a single point mounted at the side of each unit.



There are two 33 kV equipments in this "Weatherbeater" unit

News of the Week

WINDING-UP FOR VACTRIC

Appeal for more time rejected

THE Vactric domestic appliance business is to be wound up. On Monday, Mr Justice Pennycuik in the High Court made an order for the compulsory winding-up of Vactric Ltd, on a petition by Wilson Advertising Ltd, of Manchester, who claimed a debt in respect of advertising for £105,379. He refused to grant a three-week reprieve in order that a statement of affairs could be produced. For Vactric Ltd, Mr L. J. Morris Smith claimed that this statement should disclose a position on which proposals might be based for the unsecured creditors—proposals either for a composition or a moratorium which would produce more benefit for them than a winding-up order. He asked leave for hearing out of time of three creditors, with aggregate debts of about £390,000, who wished to oppose the petition.

The draft accounts for last year showed a loss of over £100,000, he went on, but book values showed a considerable excess of assets over liabilities of about £1 million, he maintained. The company was financed as regards liquid capital by a bank which held a debenture. On 7 Oct. last the bank appointed a receiver and manager under its debenture.

It was also announced on Monday that Mr A. J. Barsham, a director, had resigned from the board.

Liabilities of Vactric (Manufacturing) Ltd. amounted to £838,000, it was revealed at last week's meeting of creditors of that concern, the subsidiary of Vactric Ltd., who manufactured the washing machines. Of that sum, £551,000 was due to the parent company, £251,000 to trade creditors, £3,000 to expense creditors and £33,000 in respect of claims for cancellation of contracts. Assets of Vactric (Manufacturing) were estimated to realise £161,000 and, after allowing £34,000 for preferential claims, there were net assets of £127,000.

BID FOR BENHAM

GLOVER and Main Ltd. are going into the catering equipment business in a big way. Earlier this year they acquired for £1.1 million cash all the capital of James Stott and Co. (Engineers) Ltd., and now they have made a bid for the capital of Benham and Sons Ltd. For the latter concern they have offered £244,000 cash plus the allotment of £732,000 unsecured 6½% loan stock, 1964. Benham's, whose issued capital consists of 244,000 £1 Ordinary shares, made a group profit of £129,854, before tax, for the year ended 30 Sept., 1959, and their consolidated net assets at that date were valued at £837,582.

Mr J. W. Margetts, C.A., of Peat, Marwick, Mitchell and Co., receiver for the debenture holders of Vactric Ltd., reported that the manufacturing concern had suffered as the result of the decline in the demand experienced by the trade generally, and trading figures showed that for the year to 31 March last there was a loss of £64,000. The period 1 April, 1960, to 4 Oct. resulted in a further loss of £191,000. It was decided to appoint Mr E. R. Nicholson, of Peat, Marwick, Mitchell and Co., and Mr A. T. Eaves, of Harry L. Price and Co., Manchester, as joint liquidators, with a committee of inspection.

Late Deliveries-B.E.A.M.A. Statement

BEAMA have informed us that they now understand that the late deliveries referred to by the Australian High Commissioner in his speech at the Electrical Engineers' Exhibition Dinner related to plant arriving late irrespective of civil engineering difficulties. In these circumstances they recognise that their comments reported in our 20 Oct. issue were not relevant to this case and were, therefore, inappropriate in the context of the High Commissioner's speech.

Tariff Rise Likely

HIGHER tariffs in the eastern area from next April were foreshadowed at the Eastern Electricity Consultative Council's meeting on Friday. Higher wages and other costs were likely to turn the past year's net surplus of £3.9 million into a deficit, the EEB chairman, Mr H. V. Pugh, had advised.

Among equipment to be supplied by EEB to the Eastern Gas Board is a thermostatically controlled heating system to prevent the water seals of gas-holders at Brightlingsea from freezing in winter. Mr Therm has not commented.

More Amalgamations Coming?

FURTHER amalgamation of television set and component manufacturers is envisaged by Mr Jules Thorn, chairman of Thorn Electrical Industries. But he has rejected a rumour that an American takeover bid is likely for his company. Sylvania Electrical Products, of the USA, hold about one-sixth of Thorn's Ordinary shares and is the largest single holder. "but there is no question of their making any approach to us—they are more interested in expanding in Germany and Italy," he stated. It has been suggested that British firms want to reduce the virtual domination of the industry by the Philips group and its subsidiary, Mullard, and one method in this direction would be to acquire British set manufacturers. Certainly, with sales still comparatively small competition is getting even fiercer among the firms, and this week Pye launched a "free loan" scheme and on Monday next GEC is spending some £25,000 on advertising "free view" week.

Contractors fighting new cut-price practice

CERTAIN electrical manufacturers and wholesalers are soliciting orders for equipment at virtually net prices, which do not leave proper allowance for the electric contractor who has subsequently to install the material. This increasing tendency was referred to by Mr C. J. Veness, vice-president of the Electrical Contractor

Association, at the annual dinner of the Cornwall branch of the ECA recently. The Association and its members were determined to fight the practice and he warned the manufacturers and wholesalers concerned that "they would be on the losing end of the stick."

The practice is most prevalent in lighting installations, it seems, and amongst its protagonists are two or three prominent manufacturers.

The subject of apprentices in the contracting industry was also referred to at the dinner by Mr K. Farnell, principal of the Cornwall Technical College. He thought electrical contractors in the county would be hard pressed to attract the right type of lad in competition with larger installations, but if

the contractors banded together the college staff would like to co-operate in the matter. Some firms might be small and not consider it necessary take on a boy, but unless they did there would be a dearth of trained men.

Larger Bankside

THE second stage of Bankside power station may have a second generating set. Originally planned for one 120 MW machine, provision is now likely to be made for inclusion of a second smaller set. Construction of the superstructure has begun.

INSPECTION COUNCIL PROGRESS

THERE are now 15 inspecting engineers operating under the NICEIC, says the Council's Progress Report for the three months ending 30 Sept. One additional engineer was appointed from the beginning of the present month, operating in the South of Scotland and northern parts of Northumberland and Cumberland. The progress report (something separate from the report presented at the annual meeting, see page 775) notes good progress with recruiting.

In the three months covered 83 applications for enrolment were approved by the National Inspection board, 11 applications were rejected and 88 deferred for further inspection. 37 firms were removed from the roll and 57 new applications for enrolment were received.

As a result of representations by the Scottish committee of the NIC, the Secretary of State for Scotland has indicated to local authorities that the number of socket-outlets recommended in the Scottish Housing Handbook is below the reasonable minimum standard.

During the first six months of the financial year 1960-61 167 applications for enrolment as approved contractors were received, as compared with 101, 98 and 128 in the corresponding period of the three previous years. Number of applications during the first nine months of the calendar year 1960 exceeded that for any previous complete calendar month. In the technical section of the report,

the hope is expressed that the extra inspecting engineer will permit a shorter time interval between routine inspections. In some areas, the gap between inspections has been tending towards 18 months recently.

Work has continued on earth fault loop testing instruments, and has indicated that the lighter current types of instruments, injecting perhaps only 5 amp into the loop, give sufficiently accurate information ($\pm 5\%$) for proper testing of the smaller type installation, and always for testing socket outlets.

Experience has confirmed the importance of loop tests.

LARGE TRANSFORMERS

THE AEI Transformer Division is to build two 340 MVA generator transformers, value approximately £400,000, for West Thurrock power station. They are said to be the largest generator transformers so far scheduled by the CEBG. Voltage ratio at no-load is to be 18.5/300 kV, delta/star connected. Tappings catering for voltage variations of $\pm 10\%$ in 18 equal steps will be provided at the neutral end of the h.v. winding. What is claimed to be the largest transformer ever delivered to the CEBG has been supplied from the Hollinwood works of Ferranti Ltd. It is a 225 MVA, three-phase, 16/295 kV generator transformer for Willington "B" power station. Prior to dispatch, the transformer, which is oil-forced, water-cooled and equipped with resistor type on-load tapping changing gear, was subjected to rigorous tests, including impulse (at 1,050 kV full wave and 1,200 chopped wave) and full-load temperature rise tests.

Hackbridge and Hewitt Electric Co. Ltd. have just delivered a 180 MVA 275/132 to the CEBG.

OFFICIAL PUBLICATIONS

Machine Tool Industry. Report of Machine Tool Advisory Council Sub-committee. HMSO. 2s (see page 748).

A National Fuel and Power Policy. Statement by Association of Scientific Workers. 1s (see page 778).

BS 1442. Galvanised Mild Steel Wire for Armouring Cables. 4s.

BS Amendment Slips:

562, Reversible connectors for portable appliances for circuits up to 250 volts. Amendment No. 1, PD 3921; 822, Part 2, Terminal markings for d.c. traction motors and control equipment. Amendment No. 1, PD 3931; 1671, Domestic electric kettles, PD 3941; 1991, Part 1, Letter symbols, signs and abbreviations, PD 3920.



LINE FROM HUNTERSTON

In preparation for the commissioning of the Hunterston nuclear power station, near West Kilbride, on the Ayrshire coast, BIC Construction Co. have just completed the overhead line contract. Of conventional 275 kV design, the lines will operate initially at 132 kV. Our picture alongside shows the two parallel d.c. lines out of Hunterston,

which run some eight miles to a point just north of Dalry, where they form a junction with an existing line from Greenock and Saltcoats. From that junction, one d.c. line continues a further 72½ miles to Neilston substation

New Cooker Factory

RADIATION LTD. are now ready to build their new Scottish factory at Peterhead for the production of water heaters and electric cookers, Mr R. W. Byford, general manager of the company, told members of the local Professional and Business Club last week. All the legal formalities have been completed. Initially, about 50 people will be employed, but allowance had been made for extension at the factory, he said. Mr J. Muirhead, one of the company's senior service engineers in Edinburgh, is to manage the new factory.

£768 damages against L.E.B.

DAMAGES totalling £768 were awarded to an electrical fitter against the London Electricity Board in a High Court action last week. The fitter, Mr A. E. Bird, claimed damages for injuries he suffered through touching a live 6.6 kV busbar at a Hackney substation. The Board admitted liability but contested the amount of damages.

The Board had paid £1,600 into court and, by consent, the judge ordered Mr Bird to have costs of the action up to the date of the Board's first payment, the Board to have costs after 14 July.

The accident occurred on 22 Jan., 1958, when Bird was detailed to clean some switchgear at the substation. The gear should have been rendered safe, but by some mistake one of the busbars was live, it was stated. Bird touched it and was badly burned.

Resuming his job four months later he had an emotional breakdown as a result of going back to the same substation, it was alleged, and, after psychiatric treatment, left the Board's employment.

But the judge thought Bird had acted unreasonably in refusing the Board's offer of a job where he would have nothing to do with live electricity; and unreasonable in refusing treatment at a rehabilitation centre. If he had accepted those offers, his recovery would have been more rapid, and the judge held that that affected the length of period for which he could recover damages.

APPROVALS FOR GLEN NEVIS

WHATEVER action other organisations may plan, Fort William Town Council last week decided not to oppose the Glen Nevis hydro-electric scheme of the North of Scotland Hydro-Electric Board (to which we referred on 13 Oct.).

Inverness County Council Planning Committee have also agreed to approve the scheme in principle but to lodge a formal protest and to send to the Secretary of State for Scotland a report by the county planning officer which includes suggestions to ensure that the scenic beauty and tourist amenity of Glen Nevis remains unimpaired.

EXTENSION FOR E.D.A. TESTING HOUSE

WORK has just started on extensions to the testing house of EDA in Cleeve Rd, Leatherhead, where much of the testing of appliances will be carried out for the British Electrical Approvals Board. The extensions will include the addition of a second storey over the laboratory wing (which was always envisaged as the first major extension). In addition, improved photographic and X-ray accommodation will be provided at the end of the wing and the office space rearranged to suit the increased amount of work likely to be undertaken in the future. The building work is being carried out by J. Longley and Co. Ltd., the architects being Bucknell and Ellis.

NORMAN COLLINS AT ELECTRICAL CLUB

MR NORMAN COLLINS, author of "London Belongs to Me" and deputy chairman of ATV, will be guest speaker at the Electrical Industries Club's Christmas luncheon on 13 Dec. At the November luncheon last week, Col B. H. Leeson, president of the Club, made a welcome return after his accident earlier this year. Col Leeson took the chair and Mr Bernard Braine, M.P., told the "Westminster Story."

BOARDS' APPLIANCE SALES

SALES of electric cookers were the bright spot of appliance sales by the electricity boards in England and Wales during September. The total of 30,563 shown in our table below, is the best monthly figure since March last. For all other major appliances, apart from storage water heaters, the decline continues, although sales of washing machines, at 9,422 were the highest since April. Nevertheless, these totals are considerably down on a year ago, the biggest drop being in respect of refrigerators—over 40%. When assessing these figures it must be remembered that the sales by area boards represent only a part of the total sales throughout the country.

Appliance Sales by Area Boards	Sales in month ended 30 Sept., 1960		Sales in 12 months ended 30 Sept., 1960	
	Total	% change over corresponding period of 1959	Total	% change over previous 12 months
Cookers ...	30,563	+ 2.6	339,908	+ 1.3
Water Heaters:				
Immersion	15,276	-12.5	188,369	- 1.1
Storage ...	5,733	+11.4	68,156	+16.0
Washboilers	5,000	-23.5	58,346	-19.1
Washing Machines ...	9,422	-41.6	127,079	-25.0
Refrigerators	8,124	-40.6	141,241	-14.2

ELECTRICITY AT YOUR CONVENIENCE



ELECTRIC heating, water heating and shaver sockets are among the up-to-date facilities provided in a modern public convenience and left-luggage office built by Stirling Town Council, which was opened a few days ago. Mr W. Cruickshank, the burgh's sanitary inspector and inspector of cleansing, claims that the cloakroom sets a new standard in design and comfort, providing the type of accommodation expected only in first-class hotels.

Erected on a central site in Dumbar-ton Rd, the building incorporates fully automatic electric floor-warming throughout, together with a constant

supply of hot water from electric water heaters. In the gents' toilet there are also sockets for electric shavers, access to which is gained through a coin-operated turnstile. Incidentally, the plumbing is concealed in inaccessible ducts, reducing any liability for damage due to vandalism.

Tastefully finished throughout, the building is constructed in easy-to-clean materials which should withstand hard wear. Electrical contractors were Rigby-Millar (Electrics) Ltd.; the space and water heating systems were installed by the SSEB, and lighting fittings supplied by Atlas Lighting Ltd.

FUEL & POWER POLICY PROPOSED

SUGGESTIONS for a national fuel and power policy are made in a policy statement issued last week by the Association of Scientific Workers. Included amongst the ideas advanced is the basing of electricity generation on coal and back-pressure generation by industry, with oil used only where "the geographical situation warrants it," and no more Calder Hall type power stations.

The Association argue that the number of nuclear power stations to be constructed should be kept down to what is required to obtain experience of various types of reactor. They strongly support back-pressure generation, accusing the electricity supply industry of having a bad record of discouraging manufacturing industry's use of this technique by prohibitive financial terms. The Association wants an annual report published on the number of proposals made for back-pressure generation in parallel with the mains. They also say that area boards should do more to encourage off-peak consumption and to improve load factor in other ways. The demand charge for the bulk supply tariff should

be increased; it might incorporate a "small tax element" with benefits to the country as a whole.

The Electricity Council is thought to be the wrong centre for responsibility for research in the supply industry. CEGB activities in the research field are commended.

The conclusion to the policy statement underlines the Association's belief in a continuing importance of coal. One of the suggestions is that the mining industry should be able to be given a guaranteed tonnage market of fixed periods aimed to restrict fluctuations from any one year to the next of ± 5 million tons.

Electronics Show grows up

THE bi-annual Radio and Electronic Component Show is to be held at Olympia next year for the first time. The exhibition has grown too big for Grosvenor House and will in future alternate at Olympia with the Instruments and Electronics Show. The next exhibition, from 30 May to 2 June, will be by far the most comprehensive so far, with components for nuclear engineering.

R.P.M. ANSWERS

ALMOST 2,000 replies to questionnaires about resale price maintenance practice reached the Board of Trade as a result of its recent inquiry to traders. Stating this in the House of Commons last week, the President of the BoT said it would only be possible to take account of the replies received up to 7 Oct. He agreed with the questioner that the large number of replies received indicated how numerous were the trades affected and reflected the complexity of RPM questions.

MACHINE TOOLS & ELECTRONICS

ABOUT a year ago the Machine Tool Advisory Council met to consider the report which Prof Seymour Melman, of Columbia University, had prepared for the European Productivity Agency on the state of the machine tool industry in Western Europe. The basis of the report, not published, was to review the condition of the industry to meet competition from mass-produced machine tools from the Russian-dominated countries. Conclusions reached are critical of present methods of production both in Britain and Western Europe.

In "The Machine Tool Industry" the responding report of the sub-committee appointed by the Council which has just been published, Prof Melman's recommendations and criticisms are not accepted without reserve, but it is conceded that there is no cause for complacency. In so far as mass production is concerned, the point is made that Russian mass production is confined to a relatively few types of machine tool and price comparison is not so much in their favour as workmanship is against it. There is some justification in the criticisms that too large a proportion of UK machine tools are made under licence from foreign designs, but the industry has its answer for this. The report refers to the inadequate number of engineers and graduates employed on research and development. In 1958, out of 30,000 employed in some 90 firms only 25 were graduate engineers. More

money and effort must be applied to training in universities and technical colleges and to research and development generally.

On the subject of electronic controls, the committee is impressed with the work which has already been done by a few specialist firms. The scope and application is as yet limited to co-ordinate positioning and contour milling. There are other fields in which electronics can be applied, but hesitation is noticeable in using the more complex forms. This may be due to the high price of such equipment and lack of belief in their future, but in a competitive market expansion of this side of the industry is imperative.

N. Scottish Board awards contract

MITCHELL Engineering Co., of Peterborough, have been awarded the contract for the construction of a dam at Loch Nant, Argyll, for the N. of Scotland H.E. Board. The dam, 1,150 ft long and 80 ft high, will be in the Nant section, the smallest of three in the £24.5 million Loch Awe hydro-electric scheme, due to begin production in 1962. The other sections are Cruachan, which is to incorporate the first pumped-storage scheme in Scotland, and Inverawe.

NEW STYLE HOUSES FOR CUMBERNAULD

SPLIT-LEVEL type of house construction is being adopted by Cumbernauld New Town in new buildings soon to be constructed. This construction will take advantage of the sloping ground in the area (with gradients up to 1 in 7 in places) providing living rooms in the upstairs storey and bedrooms below, with floor-warming through the middle supplying warmth upstairs and a bonus of deflected heat below. The first plans incorporating these features have been approved by the Secretary of State for Scotland, and others are soon to be submitted by Cumbernauld Development Corporation.

Work is soon to commence on the first 370 houses in the Seafar precinct, and a further 250 of an improved design have been approved by the Corporation for erection at Ravenswood.

McFadzean names Export Council

BIG guns have been selected for the Export Council of Europe. Membership includes Sir Denis Rickett for the Treasury, Sir Patrick Reilly for the Foreign Office and Sir James Hutchinson, who is president of the Association of British Chambers of Commerce. Members from the electrical industry include Sir Joseph Lockwood, chairman of EMI, and Mr A. M. Browne, chairman and managing director of Hackbridge and Hewittic. As we reported on 27 Oct., Sir William McPadzean has responded to a Board of Trade request to set up the new organisation and be chairman. Primary object of the Council is to "support, stimulate and initiate" action to bring export opportunities in Europe to the notice of British firms.

AMERICAN POWER CONFERENCE DATES

SPECIAL sessions on power and fuels are to be features of the 23rd annual American Power Conference to be held in Chicago from 21-23 March 1961. Also planned are sessions on operation of supercritical power station plants and on new developments in the field of nuclear power generation. Further information about the conference, which is sponsored by Illinois Institute of Technology, is obtainable from the Institute at 35 West 33rd St, Technology Center, Chicago 16, Illinois, USA.

PRIZE FOR SIGN

ANYONE may enter a design competition being sponsored by the Electrical Sign Manufacturers' Association and carrying £335 in cash prizes. The contest is to draw an electrical sign for the façade of a ladies' fashion shop pictured on the entry form. First prize is £150 and entries close on 31 Jan.

Romania to sell Motors Here

UP to £100,000 worth of electric motors will be imported from Romania between now and 30 Sept. under the terms of a three-year trade agreement signed last week. The quota covers motors from 1 kW to 500 kW capacity. Except for £100,000 of oil drilling equipment and £20,000 of machine tools, the motors are the only engineering goods included in a £3½ million ceiling for import licences in the first year agreed to by the UK.

Britain may export up to £4½ million worth of goods to Romania in the coming 12 months, including £2 million of plant and machinery, £50,000 of radar and radio equipment and £50,000 of electric cables. A financial agreement was also signed under which Romania will pay £1½ million in full settlement of UK war and expropriation claims.

PERMANENT EXHIBITION ON SOUTH BANK

Seventeen street lighting columns and lanterns are among the exhibits at the permanent Street Furniture Exhibition on London's South Bank, opened recently by the Council of Industrial Design. The display, which will be kept up to date, is unattended but free catalogues are obtainable from the CoID or the Design Centre. Daylight appearance is the main concern, so the columns are not illuminated at night. Our pictures show columns for A (right) and B (below) class roads



S. Wales board share costs with farmers

FARMERS in remote areas of South Wales will in future have to pay only half the cost of bringing electricity to their doors. S Wales EB will allow 50% of the total cost of rural schemes, or half the cost of overhead line in excess of 440 yd where only one farm or a few premises can be connected from a not too distant line. Hitherto an allowance has only been made when the new line was to be used for additional consumers during subsequent development. The Consultative Council, which for some months had been pressing for easier terms in remote areas as a prerequisite to a speedier programme, endorsed the Board's proposals at a meeting in Cardiff last week. The Board now expect to complete electrification of all but the most isolated areas by 1965, which the Consultative Council regard as a satisfactory advance on the original plan of 85% rural electrification by 1968. Breconshire, Glamorganshire, Monmouthshire and Radnorshire will be fully electrified by 1963 and Carmarthenshire, Pembrokeshire and South Cardiganshire by March, 1965.

During 1960-61, out of a capital allocation of £6,300,000, S Wales EB will spend £3,200,000 on improving networks and £2,600,000 on new supplies. Included in the total is £850,000 for rural electrification, which the Board envisage will enable them to connect their annual target of 1,500 farms. Part of the sum for improving existing supplies will be used to complete the changeover to alternating current of the remaining 985 direct current supplies in Cardiff and Newport. The Board will also carry on with the stepping up to 240 V of the 20,000 outstanding 200 V supplies in Cardiff and Newport, due to be converted within two or three years.

INDUSTRIAL DESIGN ADVICE

ALL large purchasing organisations should seek the help of the Council of Industrial Design, urged Mr R. Maudling, President of the BoT, in the House of Commons last week. However, he was not able to tell the House what would be the amount of Government grant made to the Council next year.

Simpler names for refrigerants

SIMPLER identification of refrigerants for compressor refrigerators is likely to be adopted as a result of a proposal by the British Refrigeration Association to the International Standards Organisation. At a meeting in Paris recently, a working party of delegates from six countries reached agreement on a system of simplified symbols which would obviate the danger of mistakes due to a multiplicity of brand names and misunderstanding in other languages. ISO will now be asked to publish the symbols for comment, with a view to having them adopted throughout the world. UK manufacturers are likely to adopt the system forthwith. Dichlorodifluoromethane (CCl₂F₂), for example, would be known as R12, and Monochlorodifluoromethane (CHClF₂) as R22.

More plant for Douglas

TO enable a 2,200 kW diesel generator to be installed at Pulrose power station, Douglas Corporation are seeking to borrow £76,500. In the application to the Local Government Board, Mr C. Anderson, borough electrical engineer and manager, in referring to the growth of load, pointed out that the Corporation could do with two generators, but were economising by asking for only one.

He estimated that by the time the new set could be installed—March, 1962—maximum demand would have reached 11,370 kW. The last remaining l.p. boiler and turbine at the station would be 24 years old and most unreliable and uneconomical to operate. If the demand increased as expected, it would be necessary to place orders for still further generating plants before the summer of 1962.

Lightmongers at the Livery Hall

SIR ALLEN BROWN, C.B.E., Deputy High Commissioner for Australia, responded on behalf of the guests at the annual dinner of the Lightmongers, held on 8 Nov. in the Livery Hall of the Guildhall. The toast was proposed by Mr T. Catten, social secretary. The president, Mr V. G. E. Gardner, commented on the growth of the Lightmongers from their original meeting of 11 in 1953. He then introduced the succeeding president, Mr R. V. Stevens. This year the cheque for charity was presented to the EIBA.

GT. YARMOUTH TO STOP SUPPLYING COOKERS?

A RECOMMENDATION by the housing manager, Mr J. E. C. Lamb, that Great Yarmouth Corporation should stop providing cookers and washboilers in Council houses is to be further considered by the Housing Committee next week. If the responsibility to provide these items were transferred to tenants, Mr Lamb estimates that the Corporation would save £9,065 a year, which would otherwise have to be spent on replacing the equipment, plus £2,000 on repairs. He proposed that existing cookers and washboilers over seven years old in Council houses should be disposed of by giving them to the tenants and those under seven years old by selling them to tenants, either for cash or on deferred terms. He estimates that sale of the older equipment could produce between £10,000 and £12,000. Mr Lamb suggested freedom of choice in future.

The Housing Committee have studied the scheme, but postponed the matter till next month for further consideration. Mr Lamb is thinking of the Corpora-

tion's future outlay. He has pointed out the anomaly between pre-war and post-war properties. In the former, tenants had to provide their own equipment, whereas in post-war houses they were installed by the Council. Equipment installed in early post-war developments was becoming obsolete and, once the Council started replacing them in the 3,375 dwellings it had built since 1947, it would be committed to a heavy capital outlay for a number of years.

More Scottish industries?

A PARTY of British industrialists, at the invitation of the North of Scotland Hydro-Electric Board, undertook a three-day fact-finding tour of N. Scotland last week with a view to the possibility of setting up new industries in the area. Among the party were Mr R. S. Banister (English Electric Co. Ltd.), Mr J. A. Aked (A. Reyrolle and Co. Ltd.) and Mr H. S. A. Ross Dilson (Partridge Wilson and Co. Ltd.).

Jingle Bells!



Testing one of the illuminated medallions in readiness for erection in Regent St. London. Measuring 12 ft to 15 ft these medallions, with angels over 10 ft tall, form the main features of the Christmas illuminations to be switched on next Monday. The set pieces are made by W. S. Chrystalline Ltd.

G.E.C. helps the blind

A BIG advance has been made in printing braille. After years of research, the Royal National Institute for the Blind has perfected a method of printing with plastic dots instead of dots embossed in the paper. One of the problems was that the plastic ink has a gelling temperature near the flashpoint of the paper. In consultation with General Electric Co. this was solved by using infra-red sheathed wire heating panels to heat the paper evenly. Thinner paper can be used than for the embossed method, and the dots are not crushable.

SUPPLY INDUSTRY INVESTMENT

INVESTMENT needs and investment policy of the nationalised electricity supply industry received attention from many MP's during the House of Commons debate last week on the recent White Paper on public investment (ELECTRICAL TIMES, 10 November). The debate was opened by the Chancellor of the Exchequer who noted the continued ten-year doubling of demand for electricity.

On the question of varying the level of investment in nationalised industries as a weapon for controlling the economy, the Chancellor warned that unless reasonably firm plans were made well in advance it was impossible to get full value for money. Therefore, there was a large proportion of nationalised industry investment which could not sensibly be varied within the time scale that would be useful from a broad economy point of view. It also had to be remembered that the nationalised industries had end-products basic to the national economy. That implied that it was dangerous to restrict their expansion too much.

On the whole, the Chancellor thought the industries should earn a return which would cover depreciation, obsolescence and interest and still leave something over with which to build up reserves.

Sir Toby Low, who is chairman of the Select Committee on Nationalised Industries, suggested that the Government should concern themselves only with what a nationalised industry was borrowing, not with how much it could invest as a result of the surpluses it earned. Noting that the Select Committee on Nationalised Industries was likely to make a report on each nationalised industry about once every seven years, he suggested it might have a "short and quick inquiry" immediately after an investment White Paper such as that recently issued.

Mr G. Nabarro spoke at length on electricity supply, and wanted investment control by an annual bill, limiting the lending of each industry for the year ahead. Mr R. Gresham Cooke thought that at least half the capital investment of the electricity industry ought to come out of the industry's own reserves. He thought it wrong to charge (as he alleged) a unit price which was the same all over the country. Another MP, Mr N. Ridley, argued that hydro-electric plans in the Scottish Highlands should be cut heavily.

Replying to the debate, the Minister of Power, Mr R. Wood, said that the

question of differential tariffs should be left to the commercial judgment of electricity boards. On investment generally, he reiterated the official opinion that it was only possible to cut or expand investment in short-term programmes. Unfortunately, merely because a project was short term it was not necessarily less urgent or important than a long-term programme. Later, the Chancellor of the Exchequer expressed himself as having an open mind on the idea that investment plans should be considered by the Select Committee for Nationalised Industries immediately after publication.

Ulster's search for nuclear station site

PRESENTING a supplementary estimate of £11,000 to defray the cost of investigations for a nuclear power station site, Lord Glentoran, Northern Ireland Minister of Commerce, said no statement could yet be made about the location of Ulster's nuclear power station, except that it would be in a coastal area. They were looking for a site for use at a time when they might decide that generation by nuclear power would be an economic development.

The Minister added that he would be reporting to Parliament about the conclusions reached regarding the future form of electricity development when it was decided what was the best course to adopt.

The £11,000 supplementary vote asked for (and subsequently approved) was required to pay contractors and consulting engineers. Lord Glentoran added that money had already been spent on investigations in the Lough Neagh area, but although a suitable site had been found there, it was ruled out for public health and safety reasons, although many advantages could be claimed for that site.

Now the N. Ireland Government is considering other locations.

Supply Union's Plan

THE unions' plan to thwart the trouble-making unofficial shop stewards' committee in the Electricity Supply Industry was approved by leaders of the five unions on Monday. They now propose to have early negotiations with the Electricity Council with the aim of amending procedure mainly at local level. The idea is to have regular local meetings between the men's representatives from works committees and the union officials who sit on the district joint industrial councils.

It is hoped that this change will eradicate any tendency to form unofficial groups among the members.

There is a further suggestion of alteration of the constitution of the NJIC to permit district officials to attend local meetings at power stations and depots, a change which would require approval of the signatories of the Agreement.

Civil Service Scientists

ALLEGATIONS that half the vacancies in the Senior Scientific Officer grade of the Civil Service were not being filled because of recruiting difficulties, and also 80% of vacancies in the Scientific Officer grade, were made by Capt D. Ginsburg, MP for Dewsbury, in a House of Commons question to the Prime Minister last week. The Prime Minister in reply pointed to the excess of demand over supply where scientists were concerned, but admitted that salaries might be inadequate in the Scientific Civil Service. The matter was being studied by the Pay Research Unit, which was about to make a report. However, extra pay would not increase the overall number of scientists available to industry and the Government.

Tyne 275 kV line

JARROW Council are still objecting to the proposed 275 kV line route across the Tyne. They want the line placed underground where it will pass through the borough. The power line, between Blyth and Tees-side, is planned to pass through the eastern part of Jarrow into South Shields and beyond.

Long negotiations were followed by a public inquiry, since when Jarrow has suggested a further route to the four already put forward. Last week the County Planning Officer, in a letter to Jarrow Housing Committee, invited the latter to withdraw their objection requiring the line to be placed underground. The Committee decided otherwise.

Wholesalers to move

ELECTRICAL wholesalers since 1924, W. L. Turner, of Victoria St, S.W.1, have now become a limited company. The change presages the semi-retirement of Mr W. L. Turner, joint founder (with his father) of the firm, and the business is to transfer to larger premises in Rochester Row early in the new year.

At the dinner-dance of the ASEE Golfing Society, which concluded a most successful season, the captain, Mr E. C. Green, announced that £100 had been collected for the EIBA. Our photograph below shows, left to right, Lady Eccles, Sir Josiah Eccles, Mrs E. C. Green, Mr E. C. Green, Mrs Maddox and Mr Maddox, at the function



COMPUTER FILM

A FAST-WORKING data processing computer is the subject of a publicity film entitled "The AEI 1010 in Industry." The 1010 (its title is the binary equivalent of 10), is a digital computer which, working in conjunction with peripheral equipment, is capable of taking over the whole of the "paperwork" associated with production, accounting and sales of the largest manufacturing concerns. Peripheral equipment consists of magnetic storage drums, card and tape punching machines, line printers and other devices whose function is to enable information to be fed into the computer and stored, the required results being tabulated. The particular feature of the 1010 is that its speed of working, 70,000 operations per second, is many times that of the peripheral machines. This enables it to handle several programmes, in effect simultaneously, by dividing the relatively large computing time made available. Once installed, the computer can be set to work with the minimum amount of equipment to handle initially, say, the wages of a particular company. Its range can then be gradually extended.

Retail Sales Steady

THE retail picture remained much the same in October as in September, with durable goods sales again well below the level of a year earlier and sales of clothing and footwear buoyant. Allowing for a 1% rise in prices, overall sales were about 3% higher in volume than a year ago.

150th ANNIVERSARY

IN celebration of their 150th anniversary, C. F. Casella and Co. Ltd. have published a brochure which, in addition to illustrating a selection of the laboratory and industrial instruments which they manufacture, gives a brief outline of the firm's history and growth.

Sayings OF THE WEEK

"Plenty of socket-outlets provide flexibility without flex." . . . MR C. T. MELLING, at the NICEIC annual luncheon.

"Unless reasonably firm plans are made well in advance, it is impossible to get full value for money. Therefore, there is a large proportion of public investment that cannot be sensibly varied within the time scale which would be relevant." . . . THE CHANCELLOR OF THE EXCHEQUER, speaking about altering nationalised industry investment plans to meet economic difficulties.

"With the right extended training scheme every apprentice would carry a chairman's pen in his tool kit." . . . THE DUKE OF EDINBURGH, at presentation of the Gauge and Toolmakers' Association.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, November 15

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	225½	+½	ZINC, virgin, min. 98% purity (cash) ...	86½	-2
" (3 months) ...	225½	+½	" (3 months) ...	87	—
LEAD, refined pig. 99·97% purity (cash) ...	68	-1½	RUBBER, per lb No. 1, RSS, spot ...	26½d	-½d
" (3 months) ...	69	-½	c.i.f. basis, ports. Jan. ...	26½d	-½d
TIN, refined, min. 99·75% purity (settlement) ...	803	+3	ARMOURING: Galv. Steel Wire (Ø·104 in.) ...	64½	—
" (3 months) ...	799	+1	Mild Steel Tape (Ø·04 x 1½ in.) ...	53*	—
ALUMINIUM, Ingots 99·99·5% ...	186	—	NICKEL (home) ...	600	—
wire bars (4 x 4 x 54") ...	193½	—	MERCURY (76 lb flask) ...	70½	—
BRASS Strip 63/37 ...	201	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
SILVER (Troy oz) ...	79½d	—	Lead, (New York) ...	12c	—

* Tape Price, now an average, includes varnishing

Traders protest at Honiton Exhibition

ELECTRICAL retailers in Honiton have protested at the exhibition and sales drive of electrical appliances organised in the town by the South Western Electricity Board last week. The Mayor of Honiton, Ald F. W. C. Tucker, refused to open the exhibition because he maintains it is the Board's job to sell electricity, not to compete against private traders. "It should be the duty of electricity boards to plough back any profits made from the supply of electric current to reduce the cost of electricity, not to dabble in financing hire-purchase of electrical appliances," he declared.

Commenting on the Mayor's remarks, Mr F. Richardson, Exeter district manager to the Board, said the object of their trading was to develop the sale of electricity. It was their experience that such exhibitions were of benefit to all electrical traders in the towns where they were held. He also pointed out that in 1956 the Herbert Committee had

recommended that retail trading and contracting by electricity boards was in the best interests of consumers, and that the consumer could best be protected by free competition between the boards and private business.

News in Brief

By ten votes to nine, Bromsgrove Urban Council has decided to provide a choice of electricity or gas in houses to be built at the Charford estate "as an experiment."

The Electricity (Amendment) Bill, which proposed permission for the CEGB to make and sell radioisotopes, is to be debated in the House of Commons on Monday next.

Arrow Electric Switches Ltd. last week entertained some 200 of their customers and friends at a cocktail party at Queen's Hotel, Birmingham.

Amongst new work recently started by BSI is preparation of a standard on hand-operated a.c. and d.c. switches for aircraft to replace BS G129 and BS G145.

Some 240 members and their guests attended the annual ball of the Ipswich and District Electrical Association at the Royal Hotel, Clacton, on 4 Nov. So popular has this function become that it gets increasingly difficult to find a venue sufficiently large to accommodate all those wishing to attend.

Educational Productions Ltd. have published a wall chart which illustrates an electric kiln and its component parts, together with biscuit and glaze firing. It is priced 1s.

First deliveries of uranium fuel arrived at the new Berkeley nuclear power station last Thursday.

The first major exhibition on atomic energy ever to be held in Wales opened at the Welsh College of Advanced Technology, Cathays Pk, Cardiff, on Monday. Presented by the UKAEA, it continues until 26 Nov.

Benjamin Electric Ltd. held a further two days' conference and course for electrical wholesalers' sales representatives at their Tottenham works on 10-11 Nov.

Cost Engineers' Group

A BRITISH group of the American Association of Cost Engineers has been established, with the same objectives as the parent organisation. The group is already able to provide members with a library and reference service, and a series of regular meetings are proposed, the first of which will take place in London on 12 Dec. Chairman of the British group is Mr J. H. Herbert (Kellogg International Corpn), with Mr K. M. Curwen (Allbright and Wilson), as deputy chairman. Other details are obtainable from the secretary, Mr T. B. Woods, 32 Spring Close, Sherborne St. John, Basingstoke.

NEW SUBSIDIARY

DESOUTTER Brothers (Holdings) Ltd. has subscribed 76% of the issued capital of a new subsidiary—Carter Stevens (Automation) Ltd.—to carry on the businesses of Carter Stevens and Co. (Engineering), Carter Stevens and Co. (Automation) and Blakeman Designs, all of Coventry.

Company Activities

NNEDY wins. And the cry is 'inflation.' That is how the crats' victory in the US Presidential n has been widely interpreted. is, of course, every reason to that when Mr Kennedy takes over January there will be vigorous pts on the part of the US Admini- n to speed up economic advance. St, at first in two minds about it ay after the polling, decided that outs of inflation can be expected— p rocketed the Dow Jones indus- share index by 11 points from the low to finish at 602.25. The same a London the *Financial Times* inal ordinary index fell away 3.1 to 312.5. London, by still refusing llow the Wall St lead, is perhaps ng greater common sense in its ite of the post-election implications e US economy. And that is that harm than help would be the result S industry if Kennedy were to give o the alleged stimulative forces of on. Already embarrassed by its balance of payments deficit, aggra- by the continuing outflow of gold, resh round of internal price ns is inevitably going to price US out of world markets. Many say that they are already at that And if they become more so that l, of course, lead to a deepening of distrust now surrounding the dollar. fore, I think we shall find that Mr dy will tread very softly indeed the pedals of inflation. Equity grow on the facts or the smell of on. Wall St last week was away. on at the moment hesitates. And way there is less likely to be a -burning fall-back later on. ctrical shares, too, last week were be most part dull. In the heavy le, GEC dropped back 6d to 32s 9d, eased 1s 6d to 43s 3d, and English ic retreated 9d to 32s 9d. Else- , Thorn Electrical were 9d cheaper

Insulated Callender's Cables
unsatisfactory profit position on l.v. power cables and wiring and al cables in recent months is ed in a decline in the trading is for the six months to 30 June The figure is £4,469,000, compared £4,806,000 for the corresponding l of 1959, although group sales ded by £11 million to £74 million. taxation, etc., net profit for the l is £1,748,000 (£1,791,000) and the n dividend is maintained at 4%. e basis of current trading, indica- are that the profit for the whole of should not differ materially from f last year, Sir William McFadzean, hairman states. He points out that ull effect of the severe price cuts

at 45s and E. K. Cole slipped 1s 3d to 21s 1½d.
The 10s Ordinary shares of the Decca Record Co., however, found their way into the "hit parade" with an against the trend rise of 1s 9d to 50s 4½d. Chairman Mr Lewis gave shareholders a pretty cheerful report at last week's meeting. With seven months of the company's current year gone he has never felt more confident about the company's trade in gramophone records. Transistor radio sales had been much greater than last year although there has been the inevitable drop in TV sales.
On the upturn, too, the £1 Ordinary shares of British Insulated Callender's Cables edged up 1s 3d to 48s 9d, although half-time net profits have come back from £1,791,000 in the six months to 30 June, 1959, to £1,748,000 for this year's first six months. And that is on group sales £11 million higher at £74 million. It indicates that the effects of the now abandoned cable price war are still being felt. But as price war contracts come to be worked off the newly raised prices, under BICC's lead, will then begin to benefit the company's profit and loss account. It is more on expectations, with the group's turnover being maintained in the second half of the year, rather than on actual results that dealers marked up the shares. The interim has been repeated at 4% and chairman says that on the basis of current trading, indications are that the profits for the whole of 1960 should not differ materi- ally from those of last year. That points at least to a maintenance of the twice covered 13½% total dividend and on the basis of which the shares now yield 5½%.
Disappointment of the week was Joseph Lucas (Industries) where, despite the 1½% increase in the dividend to a thrice covered 13½% and the net profit rise from £2,527,437 to £2,923,424, the £1 Ordinary shares slumped 4s 4½d to 60s.—From our City Correspondent.

in cables was felt in the first half of this year, and although the company has taken the initiative to lead prices to modest but sensible economic levels, these will not be reflected to any important degree until next year. The many other activities of BICC have continued to make good progress, he adds.
Burgess Products Co. Ltd.
With improved profit figures, dividend for the year to 31 July last is raised 5% to 20%. Group profit is £303,317 (£90,220).
Contactor Switchgear Ltd.
The reduction in profits is due mainly to increased competition and an all round rise in the cost of production, Mr

H. Rayner, the chairman, reports. The new factory at Leominster is now in production. Orders have been coming in

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	164,307	65,084	57	18	13/4	10/6
1957	201,687	76,698	67	20*	10/6	8/4
1958	222,608	85,016	49	14	13/-	9/-
1959	191,663	78,901	43	14	17/-	12/-
1960	170,130	58,209	32	14	18/6	14/-

* Plus 50% capital bonus.
well, ensuring that both works will be fully occupied in the current year. Last August, the business of Radio Aids Ltd. was purchased and the name has been changed to Contactor Switchgear (Electronics) Ltd. They are in process of being moved from Watford to the Wolverhampton Works.
Dictograph Telephones
For the year to 31 Aug. last, net profit after tax is £183,327 (£150,327) and a final dividend of 10% makes the total distribution 20% (against the equivalent of 15% last time).
Engineering and Lighting Equipment Co.
There is to be a one-for-one scrip issue.
Lightfoot Refrigeration
A substantial loss is anticipated for 1960, due principally to trading conditions in the domestic refrigeration market, Mr B. T. Aikman, chairman, states, and no dividend is to be recommended. It has been decided to discontinue this relatively new activity in order to avoid further losses. (The firm handled "Linde" refrigerators made in West Germany.) Contracts in hand for the main business of refrigeration engineering are now a record, and the directors are confident that a sound profit-earning basis will have been re-established by the beginning of the next financial year.
Metal Industries Ltd.
Maintaining an interim dividend of 6% on the larger capital (with the acquisition of the Lancashire Dynamo group and the one-for-four rights issue) the chairman, Sir Charles Westlake, reports a group profit of £1,132,000 for the six months to 2 Oct. last. This compares with £850,000 for the corresponding period of 1959 (prior to LD takeover). The 1960 balance comprises £722,000 profit of the original M1 group for 26 weeks and £448,000 of LD for approximately 32 weeks. The group order books are 30% up on the same time last year and inquiries and orders maintain their encouraging levels, Sir Charles adds.
Sun Electrical Co. Ltd.
After charging taxation at £78,210 (£45,200), net profit for the year ended 30 April last increased to £71,922 (£60,885). The final dividend is raised 1% to 13½%, making the total 18½% (15%).
Yarrow and Co. Ltd.
After taxation, the group net profit for the year to 30 June last is £340,434 (£315,646), and dividend is again 17½%.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

- 17 Nov.—**Belfast C.C.** Electrical installation in Assembly Hall, Dunkeld Gdns Modern Secondary School for Girls.—See 27 Oct. issue.
- 17 Nov.—**Birmingham C.C.** Socket-outlet installations and lighting installation repairs in 250 houses at Acoc's Green.—See 20 Oct. issue.
- 17 Nov.—**Darfield U.D.C.** Rewiring of 118 houses.—See 3 Nov. issue.
- 17 Nov.—**Edinburgh C.C.** Electrical installation in Bristo Technical Institute laboratory. Applications to City Architect, City Chmbrs, by above date.
- 17 Nov.—**Penybont R.D.C.** (b) 140 W sodium lighting on 25 ft columns scheme at Llangynwyd.—See 10 Nov. issue.
- 18 Nov.—**Breconshire C.C.** Electrical work at County Surveyor's Depot, Beili Bedw, Sunnybridge.—See 10 Nov. issue.
- 18 Nov.—**Gateshead B.C.** (a) Electrical installation in four-form entry Greenwell County Secondary School for Girls. Applications to Borough Surveyor, Swinburne St, by above date. Deposit £3, made payable to Borough Treasurer.
- 18 Nov.—**Glasgow C.C.** Supply of electrical material for year from 1 Jan. Manager, Housing and Works Dept., 266 George St, Glasgow C.I.
- 18 Nov.—**Hornchurch U.D.C.** Class "A" lighting, Trunk Rd A13; (1) resiting of 30 steel units and erection of 34 steel units; (2) supply of 34 steel columns; (3) supply of 83 lanterns; (4) supply of 83 sets control gear; (5) supply of 83 horizontal 400 W MBF/U lamps.—See 3 Nov. issue.
- 18 Nov.—**Maldstone B.C.** Electrical installation in conversion of 107 Tonbridge Rd into an old people's hostel.—See 10 Nov. issue.
- 18 Nov.—**N.I. Housing Trust.** Plumbing, electrical and patent tile subcontract in 47 dwellings, Kary Hill, Downpatrick.—See 10 Nov. issue.
- 18 Nov.—**Old Fletton U.D.C.** Improvement to Group "B" standard of 58 street lighting units.—See 10 Nov. issue.
- 19 Nov.—**Halesowen B.C.** Supply and erection of 60 Class "A" and 70 Class "B" street lighting units on concrete or steel columns along various roads.—See 10 Nov. issue.
- 21 Nov.—**Bradford C.C.** Electrical installations in 22 flats at Holme Wood Housing site (scheme 61). Engineer and Surveyor, Town Hall. Deposit £2 2s.
- 21 Nov.—**Chertsey U.D.C.** Erection of 92 25 ft and 23 15 ft concrete columns plus two steel columns and installation of fluorescent, sodium, mercury and tungsten lighting and for dismantling 64 15 ft columns.—See 10 Nov. issue.
- 21 Nov.—**Diss U.D.C.** Supply and installation of street lighting at Mere St, Diss.—See 10 Nov. issue.
- 21 Nov.—**Haverhill U.D.C.** Supply of 14 Group "B" 15 ft columns and lanterns suitable for tungsten or 80 W mercury lighting with chokes and control gear.—See 10 Nov. issue.
- 21 Nov.—**Morpeth R.D.C.** Electrical installations in 18 houses, Mitford.—See 3 Nov. issue.
- 21 Nov.—**Nuneaton B.C.** Erection of 126 columns and wiring: 39 85 W and 35 60 W sodium and 52 100 W tungsten lamps.—See 10 Nov. issue.
- 21 Nov.—**Selby U.D.C.** Supply of street lighting equipment: (a) 30 140 W sodium lanterns and auxiliary equipment; (b) 22 pre-stressed spun concrete columns; (c) eight steel columns. Engineer and Surveyor, H. E. Phillips, 12 Pk St.
- 21 Nov.—**Swinton and Pendlebury B.C.** Electrical installations in 76 dwellings at Clifton. Borough Engineer and Surveyor, Town Hall.
- 21 Nov.—**Wednesfield U.D.C.** Supply, erection and wiring of 17 Group "A" Stanton 8F columns with mercury lighting and three Group "B" mercury equipments on columns to be supplied by U.D.C.—See 10 Nov. issue.
- 21 Nov.—**Wetherby R.D.C.** Electrical installation modernisation in (Group 1) 58 houses, Wetherby, and (Group 2) 50 houses at Clifford, Collingham, East Keswick, Torner and Weeton. Housing Manager, Council Offices.
- 23 Nov.—**Durham C.C.** (b) Electrical installations in High Conscliffe new County Junior and Infant School. Applications to County Architect, South St, Durham, by above date.
- 23 Nov.—**East Kesteven R.D.C.** Provision of additional power and lighting points included in modernisation schemes involving minor structural alterations, the provision of hot water supplies and other plumbing work in (Contract 1) 72 houses at Ruskington and Anwick; (2) 79 houses at Ashby, Barkney Fen, etc.; (3) 75 houses Billingham and North Kyme. Architect, Council Offices, Northgate, Sleaford.
- 24 Nov.—**Dublin.** Electrical installation in proposed pathological laboratory and mortuary building at Sir Patrick Dun's Hospital.—See 3 Nov. issue.
- 24 Nov.—**Manchester C.C.** Electrical installations in 31 houses and four shops, Partington. Contract 330/331. Director of Housing, Town Hall.
- 24 Nov.—**Middlesex C.C.** Contract Sub. 39. Wiring, lighting and heating of power house at Deepfams Sewage Wks, N.9, by contractors with d.c. experience. Contract includes supply of miscellaneous plant and an automatic telephone exchange.—Advertised 3 Nov. issue.
- 24 Nov.—**Ystradgynlais R.D.C.** Supply of 178 sodium lanterns and accessories. Surveyor, Council Offices, Ystradgynlais, Swansea.
- 25 Nov.—**Caernarvon B.C.** Supply and erection of 86 25 ft steel columns, complete with 140 W sodium lighting and supply only of 14 wall brackets with 140 W sodium lighting/control gear/time switches.—Advertised 10 Nov. issue.
- 25 Nov.—**Manchester C.C.** Electrical installation in Harpurhey Technical High School for Girls.—See 3 Nov. issue.
- 25 Nov.—**Wembley B.C.** Provision and erection of 324 sodium and fluorescent Class "A" units and removal of existing columns. Borough Engineer and Surveyor, Town Hall.
- 25 Nov.—**Woodford Green.** Applications invited for inclusion in (No. 4) list of approved electrical contractors, Claybury Hospital.—See 10 Nov. issue.
- 26 Nov.—**Alfreton U.D.C.** Installation of 134 Atlas 140 W sodium lamps and Stanton concrete columns. Engineer and Surveyor, Council Offices, Nottingham Rd. Deposit £2 2s.
- 28 Nov.—**Aberdeen C.C.** Supply of lamps during 1961.—Advertised 3 Nov. issue.
- 28 Nov.—**Lanark C.C.** Street lighting equipment for A8, Dewhill: (1) eight 280 W sodium lanterns; (2) 16 leak transformers; (3) 16 capacitors; (4) eight 35 ft columns with 9 ft outreach.—Advertised 10 Nov. issue.
- 28 Nov.—**Lisburn.** (a) Electrical installation in Wallace High School extension, Antrim Rd.—See 10 Nov. issue.
- 28 Nov.—**Stockport B.C.** Supply of 850 Class "B" concrete street lighting columns. Borough Surveyor, Town Hall.
- 29 Nov.—**Londonderry B.C.** Supply of school equipment including: film projector, radio, record player, suds pumps, mobile resistance unit, variable capacitor, wattmeter, galvanometer and oscilloscope. Director of Education, Brook Pk.
- 30 Nov.—**Croydon B.C.** Electrical installation in Oval School, Oval Rd. Borough Engineer, Town Hall.
- 30 Nov.—**Edinburgh.** Electrical engineering maintenance contract for year to 31 Dec, 1961, in hospitals for Royal Victoria and Associated Hospitals' Board of Management.—See 10 Nov. issue.
- 30 Nov.—**Hampstead B.C.** (1) Supply of lanterns and ancillary equipment for colour corrected mercury lighting; (2) supply and erection of Group "A" specified tubular steel columns, installation of equipment in contract 1 for 5½ miles of Group "A" lighting. The latter contract also includes the removal of existing Group "B" lighting. Borough Engineer and Surveyor, Town Hall, Haverstock Hill, N.W.3. Deposit £2 2s.
- 30 Nov.—**Tottenham B.C.** Supply of (Item 3) lamps for year.—See 27 Oct. issue.
- 1 Dec.—**Chesterfield B.C.** Supply of: (1) 88 25 ft tubular steel columns and one wall bracket; (2) 71 140 W sodium Group "A" lanterns; (3) 18 3 by 80 W fluorescent lan-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 110 queries answered this week

"Pollyput" polythene electric kettles—suppliers of? G.E.W.—G. and E. Equipment and Contracts Ltd., Gore Rd Wks, New Milton, Hants.

"Jeant" bell pushes—makers of? E.B.—Fitzgibbon and Murray Ltd., Smallfield Wks, Horley, Surrey.

"Lindner" lighting fittings—makers of? T.E.—Loblite Ltd., Third Ave, Team Valley, Gateshead-on-Tyne 11.

"Columbus" time switches—makers of? M.E.—Elkay Electrical Mfg. Co. Ltd., 42 Woburn Pl, W.C.1.

"Rototherm" thermometers—makers of? L.E.B.—British Rototherm Co. Ltd., Station Rd, Merton Abbey, S.W.19.

"Kaloric" convector heaters—address

for? J.D.W.—M. and J. Lossos and Co. Ltd., 31 Beethoven St, W.10.

"Whirlpool" washing machines—address for spares? E.D.A.—Home Electric Washer Co. Ltd., 17 Aylmer Parade, Highgate, N.2.

"Beekay" mincing machines—agents for? R.C.S.—The Brattell Electric Co. Ltd., 1 Dover Yard, W.1.

"Alumbro" aluminium-brass alloys—makers of? G.W.B.—Imperial Chemical Industries Ltd., Metals Division, 81 High Holborn, W.C.1.

ANSWER WANTED

"Neta" extractor fans—makers of? M.A.C.—

and 18 400 W coloured corrected lanterns complete with lamps/gear; 140 W sodium lamps/jackets/gear for Exeter-Leeds Trunk Rd lighting. b Engineer's Office, Town Hall. £2 2s.—Advertised in this issue.

—**Braintree and Bocking U.D.C.** (1) n of 112 Group "B" prestressed columns; (2) supply, erection and of 115 45/60 W sodium lanterns; ng cable ducts; (4) dismantling exist- installation; (5) incidental works.— sed 3 Nov. issue.

—**Cambridgeshire C.C.** Supply, ere- viring and fitting: (1a) nine 35 ft lums with 200 W sodium lighting at Gibbet roundabout (A45 and A14); ght 35 ft steel columns with 200 W lamps at Four Went Ways rounda- A11 and A604); (2) five 25 steel s with 3 by 80 W fluorescent lamps / Toll junction near Newmarket (A11 45).—Advertised 10 Nov. issue.

—**Chigwell U.D.C.** (i) Supply of (a) el columns and (b) lanterns/lamps; ction and installation of 21 200 W units for A11 No. 2 lighting scheme. 1 Nov. issue.

—**Manchester C.C.** Supply and instal- of outside lighting of existing aeration at Dayvulme Sewage Wks.—Adver- Nov. issue.

—**York T.C.** Supply and erection of ,867 g.p.m. centrifugal pumps and r recirculation pumphouse at Naburn : Purification Works. Details of Con- from City Engineer, Surveyor and g Officer, C. J. Minter, 7 St. d's Pl.

—**Swansea B.C.** Supply of one 3 kW erator. Water Engineer and Manager, uidhall.

—**Stockport B.C.** 2. Electrical instal- proposed Welfare Clinic, Longford st, Reddish.—See 3 Nov. issue.

—**Kirkcaldy T.C.** (b) Electrical work tion of new hall at Links St.—See 3 ssue.

—**Matlock U.D.C.** Supply and instal- complete of nine sewage pumps at umping stations in Darley Vale.—See ssue.

—**Waterford C.C.** Supply and erec- f two 20 g.p.m. pumps and 380 V motors for Kill and Bonmahon water scheme. Details from consulting ers, H. N. Walsh and Partners, 47 s Well, Cork. Deposit £2 2s.

—**Dumblane B.C.** Supply and erection

of seven Group "A" concrete columns/lan- terns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. ssue.

1 Feb.—**Oxford T.C.** Supply and erection of two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. ssue.

No date stated—**Queensferry B.C.** Electrical work in erection of public lavatories and surveyor's stores and in alterations in High St flatted houses.—See 10 Nov. ssue.

No date stated—**North of Scotland H.E.B.** 33 kV switchgear for Burghmuir substation, Perth. Chief Electrical and Mechanical Engineer, 16 Rothesay Terr, Edinburgh 3. Deposit £2 2s.—Advertised in this issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

21 Nov.—**Greece.** 4,000 metre 500 V, 1,000 metre 1 kV and 700 metre 15 kV cable. Office of State Procurements Services, 50 Socrates St, Athens. B.o.T. (ESB/29151/60).*

23 Nov.—**Iraq.** Ten mile telephone cables. Ministry of Defence, Director of Contracts and Purchases, Baghdad. B.o.T. (ESB/28897/60).*

24 Nov.—**Pakistan.** (1) 100,000 yd single-core v.i.r. cable; (2) 50,000 yd v.i.r. cable; (3) 100,000 yd twin 14/0076 cotton covered flexible; (4) 75,000 yd artificial silk insulated flexible. Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/29144/60).*

28 Nov.—**America.** (1) 50,000 ft 4-core and (2) 10,000 ft of 3-core 16 AWG rubber insulated cable. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Purchase Contract Unit, Bldg 53, Denver Federal Center. B.o.T. (ESB/29152/60).*

29 Nov.—**India.** One 20 h.p. centrifugal pump. Additional Chief Engineer (Con- struction), Civil Branch, Kerala State Elec- tricity Board, Post Box 21, Trivandrum 1. B.o.T. (ESB/29375/60).*

30 Nov.—**India.** Cable p.i.l.c.d.w.a. for Swang Collieries. Purchase Officer, National Coal Development Corp., 1 Council Hse St, Calcutta 1. B.o.T. (ESB/29180/60).*

30 Nov.—**Pakistan.** L.T. cables and wires. Director, Directorate of Supply, P.I.D.C. Hse, Motijheel, Dacca 2. B.o.T. (ESB/29194/60).*

2 Dec.—**India.** One 150 h.p., 3.3 kV motor and one 3.3 kV o.c.b. National Coal De- velopment Corp., Chief Purchase and Stores Officer, Darbhanga Hse, Ranchi. B.o.T. (ESB/29185/60).*

5 Dec.—**Argentina.** One electronic computer for bank duty. Gerencia de Administracion, Banco de la Provincia de Buenos Aires, San Martin 137, Buenos Aires. B.o.T. (ESB/29384/60).*

12 Dec.—**New Zealand.** Cables and flexibles (13 items). Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/28865/60).*

13 Dec.—**Thailand.** 100,000 lb all-aluminium conductor; 3 million ft seven-strand all- aluminium polyethylene-covered conductor and tie wire. Metropolitan Electricity Authority, Chakraphet Rd, Bangkok. B.o.T. (ESB/28861/60/DLF).*

15 Dec.—**America.** Control switchboards, motor generators, etc., for Greers Ferry Powerhouse. Little Rock District Corps of Engineers. B.o.T. (ESB/28180/60).*

15 Dec.—**Egypt.** Three 750 kW rectifiers, accessories, transformers, switchgear, etc. General Manager, Alexandria Region Public Transport Admin., 21 Midan Saad Zaghloul, Alexandria. B.o.T. (ESB/29122/60).*

16 Dec.—**Thailand.** 5,000 telephones. Tele- phone Organisation of Thailand, Phloenchit Rd, Bangkok. B.o.T. (ESB/29170/60).*

7 Jan.—**Burma.** Six three-ton portal cranes for Rangoon Port. Details, fee £8, from Sir Alexander Gibb and Ptnrs, Queen Anne's Lodge, S.W.1. B.o.T. (ESB/28599/60).*

12 Jan.—**Uruguay.** 25 main line diesel- electric locos and 14 diesel-electric shunting locos. La Seccion Licitaciones de la Gerencia General de la Administracion de Ferro- carriles del Estado, Montevideo. B.o.T. (ESB/28536/60).*

13 Jan.—**India.** Cooling towers for Chandrapura. Tender S.E.279. Details from India Store Dept., Government Bldg, Bromyard Ave, W.3. B.o.T. (ESB/28875/60/DLF).*

18 Jan.—**Thailand.** 16 230/69-12 kV auto- transformers and two 13.2 kV, 5,000 kVA shunt reactors. Director-General, Royal Irrigation Dept., Bangkok. B.o.T. (ESB/28198/60).*

27 Jan.—**Malaya.** Two 150 klb/hr boilers and auxiliary plant for Johore Bahru Power Station, Contract E.E. 1737/2. Crown Agents for Overseas Governments and Adminis- trations, 4 Millbank, S.W.1. Documents fee £15.

31 Jan.—**New Zealand.** One 30 MVA 66/ 11 kV transformer. Secretary, Tenders Com- mittee, N.Z. Electricity Dept., Wellington. B.o.T. (ESB/29192/60).*

24 Feb.—**Australia.** 60 MW turbo-generator and auxiliary plant for Tennyson Power Station. Chief Engineer and Manager, Dept. of Electricity, Kelvin Hse, Adelaide St, Brisbane. B.o.T. (ESB/28852/60).*

No date stated—**Sudan.** Consortium, includ- ing electrical engineers, required to build cotton gin factories. Details from Sudan Gezira Board Representative (U.K.), Castle Ch'mbrs, Castle St, Liverpool 2. Specification deposit £205 2s 7d.

CONTRACTS PLACED

ham C.C. Electrical work in schools: Ravensworth Terr County, T. lson (Electrical) Ltd., £1,104; Billing- Campus School, C. Horne and Co. £34,585; Durham Technical College, England Engineering and Electrical d., £2,083. Recommended.

ldford B.C. Street lighting London, esdon and Stoke roads, G.E.C. Ltd., . Recommended.

gton B.C. Electrical work at Warlters- and Manchester Mansions and 88 ille Rd, Evans and Shea Ltd., £9,512. umented.

liesex C.C. Electrical installation re- at John Perryn Primary School, ical Contracting Co., £2,459.

castle Hospital Board. Electrical work X-ray dept., Hemlington Hospital, esbrough, H. G. Sproates Ltd., £2,265; tention schemes, Prudhoe and Monk- lospital, James Scott and Co., £7,805 12,483; nurses' training centre, West erland Hospital, G. H. Bowman and £2,633.

ley U.D.C. Supply of fittings for new hall, G.E.C. Ltd. and Atlas Lighting

hton-on-Tees T.C. Electrical instal- in Hardwick shopping centre, William £2,04.

Wandsworth B.C. Electrical installations: in seven groups of dwellings, Elraes Ltd., £1,970; in six groups of dwellings, London E.B., £3,114; in ten groups, S. White (Streatham) Ltd., £4,565.

Washington (Co. Durham) U.D.C. Supply and erection of 11 street lighting units, Engineering and Lighting Equipment Co., £377; cabling by direct labour.

TRADE NOTES

Change of Address. The address of Birfield Ltd. is now 20 Hill St, W.1. The telephone no. remains Grosvenor 7090.

Agents. Findlay Durham and Brodie are acting as the London office of the South African Porcelain Insulator Manufacturers' Association (Pty.) Ltd.

Ealing Branch. Edmundsons Electrical Wholesalers Ltd. have now occupied new premises at Craven Rd, Ealing, W.5, which include a trade counter/display room, offices and stores. This branch, serving the West London postal area, supersedes the tem- porary premises which had been occupied since the depot in Uxbridge Rd was de- molished in 1957.

Regrouping. Marconi's Aeronautical Divi- sion is now being regrouped in new premises

at Basildon, Essex, where the bulk of the company's aeronautical equipment is manu- factured. The existing works were built in 1953 and in the following year the Aero- nautical Division's Sales and Contracts Group moved to Basildon from Chelmsford. A new extension has now been completed to house the entire division.

Expansion. The Chloride Electrical Storage Co. Ltd. announce that arrangements have been made under which their South African company, whose factory at East London already manufactures a substantial part of the battery requirements of the Union, will shortly take over the production and distri- bution of batteries now being sold in the Union and nearby territories under the names Bartleite, Autolite, Prestolite and USL.

BUSINESS PROSPECTS

Aldridge U.D.C. Street lighting programme for 1961 at £7,620 approved.

Amble U.D.C. 38 houses and bungalows planned on Links estate. Surveyor.

Aylesbury. Bucks C.C. plans £400,000 College of Further Education and Technical School. Architect.

Bangor. Welsh Hospital Board, Cathays Park, Cardiff, plan Bryn Menai nurses' home.

Bedlington U.D.C. £273,000 three-storey flats and maisonnettes planned at East Green, Choppington.

Belfast. Liverpool and London and Glove Insurance Co., Bow Bells Hse, Bread St, E.C.4, plan demolition of five-storey property in Wellington Pl and replacement with new building.—T.C. Tender: 36 flats, Fortwilliam Parade, Skegoniel Ave. Architects' Dept., 96 Townsend St.

Birmingham. Stella Properties (Birmingham), subsidiary of A. F. Lilley and Co., 19 Bedford Row, W.C.1, plan three- and 12-storey buildings on Dartmouth St area site.—Corporation to lease land at Barford St and Gooch St to E. F. Cash and Sons, 51 Longmore St.—Gabriel and Co., Aston Cross, plan £18,000 manufacturing premises at Prices Row and Howe St.—Welfare Committee plans site at Handsworth for multi-storey home for the aged.

Bolton. Tillotson and Son, Ashleigh, Chorley New Rd, plan new premises.

Brighton. New Welbeck Ltd., Moulescoombe Rd, plan new Westergate Rd factory and office block.—Jaycee Furniture, 23 Regent Hill, plan factory at Falmer Rd, etc., Woodingdean.—Hooper Struve and Co., Royal Spa, Park Hill, plan premises at Falmer Rd/Bexhill Rd.—Sir Basil Spence and Ptnrs, 1 Canonbury Pl, N.1, architects for £1 million Brighton University College, Falmer Rd.—Tender: College of Technology for Brighton Corporation. Architects: R. H. Matthew and S. Johnson Marshall, 24 Park Sq East, N.W.1.

Cambridge. H. Williams and Co., 43 Bedford Sq, W.C.1, architects for F. Winton Smith's factory and offices.

Cheltenham. The Colston Property Holdings, 77 South Audley St, W.1, plan multi-storey car parks.

Chesterfield B.C. Tender: 44 traditional type dwellings on Boythorpe estate. Engineer.

Chislehurst and Sidcup U.D.C. Street lighting programme to include Barnfield Rd, Francis Rd, Augustine Rd, all roads on Chalkpit estate and Ethelbert Rd.

Coventry. Following building plans in vicinity of the Airport: factory for Humber Ltd., Humber Rd; extensions for Harry Ferguson Research Ltd., Siskin Drive; bakery for Enterprise Bakeries, Stonebridge Highway.—Corporation to approve plans for £63,000 hostel for mentally ill and £22,000 sheltered workshop, Torrington Ave.—Calgary and Edmonton Land Co., 33 Avenue Rd, N.W.8, plan point block at Smithford Way.

Crawley. Stevens, Scanlor and Co., 56 Buckingham Gate, S.W.1, architects for K.D.G.'s extensions.

Croydon. 20th Century Electronics, King Henry's Drive, plan factory extensions.—Mechanism Ltd., Gyro Wks, 6a St. George's St, plan factory and offices.—J. C. Tonelli, 88 Milton Rd, plan factory extensions.

Dagenham. R. S. Stevens, 38 Marlow Rd, E.17, plan factory and offices and transport station at Fowler Rd.—N. Harris and Sons, Dominion Wks, Freshwater Rd, plan two-storey factory.—Pritchett and Gold and E.P.J. Ltd. plan assembly shop extensions, Chequiers La.—May and Baker, Rainham Rd South, plan office block and transport building.

Darlington T.C. Modernisation of electrical equipment in old council houses. Architect.

Dudley. Birmingham Hospital Board to

approve scheme for new substation and changeover equipment at Burton Rd Hospital. Cost £12,000.

Durham C.C. Branch library, Boldon Colliery, planned. Architect. F. W. Rought and Sons, Woosingham Bridge estate, promoters of 55-acre housing scheme, Broomside La.

Eastbourne. Jaeger Co. plan Brampton Rd Trading Estate factory on 1½ acres.—A. H. Hunt (Capacitors), Bendon Valley, S.W.18, plan Brampton Rd estate factory.—F. Bournier and Sons plan shops, office blocks, store, etc., at Pevensey Bay Rd.—Gee, Walker and Slater, 100 Park La, W.1, contractors for £50,000 Photax (London) factory.

Eccles. W. Thorpe and H. Hirst, Smith, 65 Barton Arcade, Deansgate, Manchester 3, architects for Mitchell, Shackleton and Co.'s new Green La machine shop.

Edmonton. Cozens and Sutcliffe, Hyde Wks, Gt. Cambridge Rd, Enfield, plan workshop of 12,000 sq ft on their land for United Steel Co.

Enfield. Planned: Factory at Crown Brickworks site, Crown Rd, for Polak and Schwarz; architects: Edward D. Mills and Ptnrs, 9 Richmond Bldgs, Dean St, W.1.—Factory and office extensions, Lea Valley Rd, for Enfield Tubular Products; architects: Bowyer and Bowyer, 6 Southbury Rd, Enfield Town.—Factory at Queensway for Stadium Ltd.; architect: D. A. Cox, 184 Turkey St.

Esh Winning. Tonay, Durham Rd, Esh Winning, plan factory and offices.

Essex C.C. £67,000 hostel for elderly persons planned at Bevan Ave, Barking. Borough Architect, Barking B.C.

Glasgow. Women's Hall of Residence planned at Clevedon Gdns, W.2, for University.

Gosforth. P. H. Knighton, Benfield Rd, Newcastle Hospital Board's architect for out-patients' department at W. J. Sanderson Orthopaedic Hospital.

Grangemouth T.C. Tender: 20 shops, 36 flats, Kersiebank Ave. Town Planner: P. S. Cocker, 66 Lumley St.

Gt. Missenden. Thurlow, Lucas and Jones, 86 Eastern St, High Wycombe, Bucks, quantity surveyors for C. Stevens and Sons' extensions at Prestwood.

Hastings B.C. Tender: 62 two-storey dwellings, three-year scheme, on site of existing Broomgrove estate houses. Engineer.

High Wycombe. Fleet and Roberts, 33 New St, Aylesbury, Bucks, contractors for Broom and Wade's £67,000 canteen and office block.

Hilton. Wright and Ingram, 11 Campden Hill Rd, W.8, architects for redevelopment of Ingfield Manor as spastics school.

Hull. Frederick Gibberd, 8 Percy St, W.1, architect for new College of Commerce.

Hunts C.C. 12-bed children's home planned at Godmanchester. Architect—Nursery Rd clinic proposed. Architect.

Ipswich B.C. Tender: Chantry estate aged persons' home for 56 people. Clerk.

Keighley B.C. Tender: Two 12-storey blocks of flats comprising 96 three-bedroom flats and 96 one-bedroom flats. Architect.

Kilkenny T.C. 38 two-storey houses, Walkin St. Architect: J. C. Thompson, 65 O'Connell St, Limerick.

Lees C.C. £10,000 children's home planned, corner St. Mary's Rd, Sileby. Architect.—County Council offices planned at Anstey. Architect.

Lindsey C.C. £44,800 junior training centre and hostel for sub-normal children planned on Wood La area site. Architect.

Liverpool. City Electrical Engineer to carry out further scheme for improvement of street lighting at Kirkby Industrial Estate. Cost £3,000.—Colgate Palmolive, Ordsall La, Trafford Pk, Manchester 5, plan factory on 1½ acres of land at Moorgate Rd.

London. Manning and Clamp, 19 The Green, Richmond, architects for six-storey cold store at Nine Elms Goods Depot.—L.C.C. Welfare Committee approves plans by Bertram Carter, 15 Adeline Pl, W.C.1, for 125-place home for the aged at Warwick Cres, Paddington, W., cost £192,750.—Five-storey paediatrics research building planned

NEW COMPANIES

Extracted from the Register Issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

M. Alexander (Electrical) Ltd., 40 Stafford St, Liverpool 3, Nom. cap.: £100. Dirs.: Maurice Alexander and Joan M. Kenwright.

J. Barnes (Electrical) Ltd., 4 Oxford St, Salford 5, Electrical engineers, etc. Nom. cap.: £5,000. Dirs.: John Barnes, Herbert Pearson and Arthur K. Seares.

T. Carnell (Electric) Ltd., 68 Glencoe Rd, Sheffield 2, Nom. cap.: £5,000. Dirs.: Trevor A. Carnell and Mrs Margaret M. Carnell.

Charles W. Martin Ltd., 107 Baker St, W.1. Manufacturers of and dealers in lampshades, etc. Nom. cap.: £3,000. Dirs.: Charles W. Martin, Irene S. Martin and Geraldine Martin.

C.B.S. (Electrical Motors) Ltd., Barnwell Hse, Newmarket Rd, Cambridge, Nom. cap.: £1,000. Dirs.: James E. Truelove and John H. Bartram.

Clayton Electrical Industries Ltd., Fairclough St, Clayton, Manchester 11, Nom. cap.: £1,000. Dir.: Ivor Bardsley.

Direct Electric and Radio Ltd., 818 High Rd, N.17, Nom. cap.: £1,000. Dirs.: Harold A. Giddy and Edward C. Higgins.

Electric House (F.G.H.) Ltd., 929 Rochdale Rd, Manchester 9, Retailers, suppliers, manufacturers of and dealers in washing machines, refrigerators, etc. Nom. cap.: £1,000. Dirs.: Francis G. Harding and Eva R. Harding.

Gilberts (Electrical Engineers) Ltd., 72 Dagenham Rd, Romford, Essex, Nom. cap.: £500. To take over the business carried on by Sydney Gilbert at Romford and Hornchurch, etc. Dirs.: Sydney Gilbert and Mrs Lily L. Gilbert.

Harmer and Simmons Holdings Ltd., Roebuck Rd, Hainault, Ilford, Essex. To enter into an agreement with Harold M. Harmer, and to carry on business of engineers and engineering in all branches of science and applied science; manufacturers of and dealers in chemical apparatus, etc. Nom. cap.: £223,000. Dirs.: Harold M. Harmer, Bernard Ingram, William E. Simmons and Reginald J. Glass.

Holden's Electrical Ltd., 74 Banktop, Blackburn, Lancs. To take over business of dealers in electrical domestic appliances carried on at 74 Banktop, Blackburn, etc. Nom. cap.: £1,000. Permanent dirs.: Harold C. Holden and June Holden.

Induction Furnace Installations Ltd. Nom. cap.: £2,000. Dirs.: to be appointed by subs. Subs.: John Byron, 5 Ashview Close, Ashford, Middx; and Mrs Christine Crow, 51 Farrance Rd, Chadwell Heath.

Trade Contractors (Electrical) Ltd., 4 Spring St, W.2, Electricians, etc. Nom. cap.: £1,000. Dirs.: Ronald Moloney and Rudolf F. Fabian.

W. L. Turner and Co. (Westminster) Ltd., 68½ Upper Thames St, E.C.4. To take over the business of wholesalers of electrical goods and merchandise carried on by W. L. Turner and Co., of Victoria St, S.W.1, etc. Nom. cap.: £10,000. Dirs.: to be appointed by subs. Subs.: George H. Sayer and Betty M. Brooks.

H. White (Electrical Contractors) Ltd., 10 Dynevor St, Georgetown, Merthyr Tydfil. To take over business of "H. White," carried on at Merthyr Tydfil; to carry on business of electrical engineers, etc. Nom. cap.: £2,500. Permanent dirs.: Henry White and Mrs R. White.

ss Prospects—Continued

ildford St, W.C.1, to cost £400,000.—
y, Luke and Moor, 43 Welbeck St,
architects for Royal College of
nary Surgeons' new headquarters,
ole St, W.1.—Clyde, Young and B.
8 New Sq, Lincoln's Inn, W.C.2,
acts for reconstruction of the Trinity
e of Music, Mandeville Pl, W.1.—
ects' Co-Partnership, 44 Charlotte St,
architects for £674,105 secondary
at Lollard St, S.E., for 1,650 boys.
P. Bennett and Son, 43 Bloomsbury
'C.1, architects for shops and offices
d at 6 Porter St, W.1.—K. Kensall,
kville St, W.1, quantity surveyors for
1 of office building at The Broadway,
-Harris and Porter, 3 Robert St,
quantity surveyors for £1 million
.C. extensions to Victoria airways
al, stage 2.
echester. Extensions to Grosvenor St
te for the Deaf planned.
burn U.D.C. Three-storey flats planned
ockley. Surveyor.
Ireland. William C. Callaghan, 26
h St, Portadown, architect for 45,000
factory proposed by Mayfair Manu-
ng Co., 57 Effra Rd, S.W.2.

Norwich. £40,300 old people's hostel
planned on site of Hill Hse, Hethersett.

Nottingham. Land and General Develop-
ments, 8 Berkeley St, W.1, plan five-storey
block of shops and offices, King St.

Oxford. Professor Sir Leslie Martin,
King's Mill, Shefford, near Cambridge,
architect for £½ million group of libraries
on Manor Rd site for University.—Murray
Ward and Ptars, 32 Wigmore St, W.1,
architects for Department of Biochemistry.

Peterborough. Oddeninos Property and
Investment Co., 52 Berkeley Sq, W.1, plan
scheme involving land at Broadway.

Plinner. L.C.C. Welfare Committee plans
extensions at Blythwood as home for aged
at cost of £91,315.

Reading. Oxford Hospital Board, Banbury
Rd, plans Caversham Hill nurses' home.—
The Berkshire Printing Co., Oxford Rd, plan
development at Craig Ave.—B.C. plan £1,500
traffic signs scheme for loop road west of
Reading.

Rochdale. £6,195 proposed provision of
sodium street lighting in streets in Joy St
estate and conversion of gas lighting to
sodium lighting in Syke Rd area streets.

Rotherham. Balfour Laboratories, 13
Industry Rd, Sheffield 9, plan cosmetics
factory, Eastwood Trading Estate.—Steel,
Peach and Tozer plan research building at
Sheffield Rd.

St. Asaph, N. Wales. Pilkington Bros. plan
Glascoed Rd factory.

St. Helena. Ministry approve B.C.'s scheme
for illumination of unclassified link roads
and bus routes with electric standards at
£13,900.—B.C. Tender: Contract 2161, 105
Burrows La site dwellings. Clerk.—Tender:
Contract 2160, 75 Greenbank No. 2 rede-
velopment site dwellings. Clerk.

Settle R.D.C. Tender: 54 houses, Good-
enber Rd East, High Bentham. Surveyor.

Sheffield. Regional Hospital Board plans
£1 million radiotherapy h.q., Whitham Rd,
Broomhill. Architects: Adams, Holden and
Pearson, 38 Gordon Sq, W.C.1.

Shipley U.D.C. Tender: 63 flats, eight
bungalows, Rochester St redevelopment area.
Clerk.

Southport. Corporation E.C. sanction new
Our Lady of Lourdes R.C. secondary school
on 17-acre site, Isle of Wight Farm.

Stafford. Birmingham Hospital Board to
approve scheme for reorganisation of electric
mains distribution at St. George's Hospital.
Cost £28,000.

Stockton-on-Tees. Corporation plans £624
improvement in lighting at Bowesfield La
Boys' School and £300 at Bailey St J.M.
and Infant School.

Stourbridge. Birmingham Hospital Board
to approve £18,500 reorganisation of electric
mains at Corbett Hospital.

Strood R.D.C. Tender: 24 dwellings,
Grain, Halling, Hoo and Stoke. Engineer
and Surveyor.

Sunderland B.C. 550 houses, Town End
Farm estate planned (Phase 3).

Thurmaston P.C. £5,000 lighting scheme
for the by-pass planned. Clerk.

Tilbury. C.E.G.B. plan establishment of
1,400,000 kW power station adjacent to the
existing station. First section to be in
operation by 1965.

Tynemouth. Northumberland Whinstone
Co., Milburn Hse, Newcastle, plan offices
and car park off Coast Rd, North Shields
site.

Wigan. Union International Co., 13 West
Smithfield, E.C.1, plan abattoir at Hartland
Mill.

Wolverhampton. Birmingham Hospital
Board to approve scheme for provision of
substation and renewal of electrical mains
distribution system at Royal Hospital. Cost
£19,000.

Workington. Shopping centre planned on
Moorclove estate. Borough Engineer.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

rdon Electrical Co. Ltd. and Foster
thomas Ltd. (London Electrical Co.).
ors to send details to liquidator:
Wale, Walter Hse, 418-422 Strand,
, by 29 Nov.

saies Ltd. Winding-up order dated

City Electric Machines Ltd. Resolu-
or voluntarily winding-up passed at
rdinary general meeting on 21 Oct.
rs to send details to liquidator: F. M.
gue, 233 High St, Poole, by 30 Nov.
orton and Co. Ltd. Creditors to send
to liquidator: R. A. Haigh, Court
s, Friar La, Leicester, by 25 Nov.
R. Electronics Ltd. Mr E. Taylor, 30-
y St, Newcastle upon Tyne, appointed
tor at extraordinary general meeting
Oct. for the purpose of voluntarily
g-up.

pa and Culling (Products) Ltd. Mr
ne, 13 Greenend Rd, W.4, appointed
tor at extraordinary general meeting
Oct. for the purpose of voluntarily
g-up.

Recorder Service Co. Ltd. Mr C.
ield, 73 Cheapside, E.C.2, appointed
tor at extraordinary general meeting
Oct. for the purpose of voluntarily
g-up.

Electric (Blackpool) Ltd. Meeting of
rs to be held at Blackpool Chamber
de, 53 Queen St, on 17 Nov., at 3 p.m.
Phillips (Electrical) Ltd. Mr K. R.
19 Eastcheap, E.C.3, appointed
tor at extraordinary general meeting
Oct.

a-Disc Ltd. First meetings of credi-
d contributories to be held at Room
veresk Hse, 346 Strand, W.C.2, on
., at 10.15 and 10.45 a.m., respectively.

BANKRUPTCY ACTS

Examinations

pool. J. Jones, electrical dealer,
g on business as Stanley Electric
s, at 374 Prescott Rd, Liverpool 13,
examination: 10.30 a.m., 31 Jan., at
Hse, Fifth Floor, India Bldgs, Water-
rpool 2.

ster. N. C. Ward, retailer of electrical
ces, formerly carrying on business as
Household Supplies, at 92 Pindar
w Parks estate. Public examination:
.m., 20 Jan., at The Castle, Leicester.
ford. P. W. Nelson, electrical retailer
gineer, formerly carrying on business
Services at 551 and 543 Wakefield
adford 4, and at 32 Town Gate,
Public examination: 10.30 a.m.,
at County Court, Bradford.

Applications for Discharge

Norwich. G. Love, cycle, radio, electrical
engineer, etc., carrying on business as Love
Bros., Holt Rd, North Elmham. Order made
on 19 Sept. on application for discharge:
Discharged as from 19 Oct.

Croydon. A. E. R. Honey, electrical con-
tractor, formerly of 13 Longton Grove,
S.E.26. Application for discharge order
dated 29 Sept.: Discharged as from 31 July,
1962.

Swindon. F. Kirk, electrical, radio and
calor gas engineer, formerly carrying on
business at 11 Railway St, Pocklington.
Order made on 12 Oct. on application:
Discharged subject to certain conditions.

Dividend

Stourbridge. P. J. Dovey, hire proprietor
of washing machines, formerly carrying on
business at 25a Collis St, Amblecote; at
Amblecote Rd, Brierley Hill; and 14 Chapel
St, Quarry Bank. Dividend per £: 4½d, pay-
able at Official Receiver's Office, Somerset
Hse, 37 Temple St, Birmingham 2, on
22 Nov.

Intended Dividend

Coventry. S. J. Barnes, electrical con-
tractor, formerly carrying on business at
3 Pim St, Antrim Rd, Belfast. Last day for
receiving proofs for intended dividend: 23
Nov., to W. H. Haigh, Somerset Hse, 37
Temple St, Birmingham 2.

TRADE MARKS

*This information is extracted from the
Official Journal by permission of the
Controller.*

Col-Dlx. 793,487. Class 7. Floor-cleaning
and polishing machines, etc. 793,488. Class 9.
Vacuum-cleaners, etc. Columbus-Dixon Ltd.,
Capitol Wks, Empire Way, Wembley, Middx.

Degussa in design. 803,504. Class 9.
Apparatus, etc. Deutsche Gold-und Silber-
scheideanstalt Vormals Roessler, 9 Weiss-
frauenstrasse, Frankfurt-on-the-Main.

Gold Star. 796,579. Class 11. Refrigerating
apparatus, cooking and drying appliances,
lighting fittings, etc. Elm Works Ltd., Elm
Wks, Summerstown, S.W.17.

Gussie. 799,996. Class 7. Machine for
domestic use, etc. 799,998. Class 9. Appara-
tus, etc. Great Universal Stores Ltd, Devon-
shire St, Ardwick, Manchester 12.

Hugmaster. 807,449. Class 10. Heaters, etc.
David Jedwab (Machinery) Ltd., 8 Hillfield
Mansions, Haverstock Hill, N.W.3.

Icemaidd. 800,603. Class 11. Refrigerators,
etc. Samuel and Son Ltd, Talbot Mills,
Ellesmere St, Hulme, Manchester 15.

Impalco aluminium in design. 801,015.
Class 9. Apparatus, etc. Imperial Aluminium
Co. Ltd., Imperial Chemical Hse, Millbank,
S.W.1.

Marwin. B801,334. Class 9. Apparatus,
etc. Marshall Ward Ltd., S.S. Bldgs, Devon-
shire St, Ardwick, Manchester 12.

Pep-Arco. 807,119. Class 7. Pumps, etc.
Precision Electrical Products (Stockport)
Ltd., Progress Wks, Lytham St, Cole Green,
Stockport.

Phillips and Philigrand. 806,749/50. Class
9. Apparatus, etc. Philips Electrical Ltd,
Century Hse, Shaftesbury Ave, W.C.2.

Plannette. 802,659. Class 11. Fans, blowers,
etc. Plannair Ltd., Windfield Hse, Epsom
Rd, Leatherhead.

Temoonk. 807,234, and **Vistonic.** 807,235.
Class 9. Apparatus, etc. Kingston Control
Systems Ltd, Empire Chmbrs, 167 Clarence
St, Kingston upon Thames.

Transtab. 801,146. Class 9. Voltage and
current stabilisers. Joye Loebl and Co. Ltd.,
Princes Wav, Team Valley Trading Estate,
Gateshead 11.

MEETINGS TO NOTE

THURSDAY, 17 NOV.

I.E.E. (Southern). "Engineering Education of the Technical Universities in Western Germany," D. B. Welbourn, Professor D. B. Spalding and G. L. Ashdown. (Joint meeting with Southern Branch of I.Mech.E.). Central Electricity Generating Board Offices, 111 High St, Portsmouth. 6.30 p.m.

I.E.E. (Irish). "Aviation, Navigational Systems," G. Jones. Physical Laboratory, Trinity College, Dublin. 6 p.m.

SCIENTIFIC INSTRUMENT MANUFACTURERS' ASSOCIATION. Convention at Eastbourne until 20 Nov.

INSTITUTION OF MECHANICAL ENGINEERS (London Graduates). "Recent Developments in L.T.E. Railway Rolling Stock," J. Styles. 1 Birdcage Walk, S.W.1. 6.30 p.m.

FRIDAY, 18 NOV.

I.E.E. (N. Midlands). Annual dinner. Queen's Hotel, Leeds. 7 p.m.

I.E.E. (N. Staffs). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Technical College, Stoke. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS. Chairman's address: "Simple Instruments for Tanks and Pipelines," E. M. Baskerville. Pepps' Hse, 14 Rochester Row, S.W.1. 7 p.m.

MONDAY, 21 NOV.

I.E.E. (N. Western). Discussion: "The Teaching of Electrical Network Theory and Its Applications in Electrical Engineering." Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N. Eastern). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (W. Utilisation Group). "The Characteristics and Protection of Semiconductor Rectifiers," D. B. Corbyn and N. L. Potter. South Western Electricity Board Demonstration Theatre, Old Bridge, Bath. 6 p.m.

I.E.E. (Sheffield). "Subscriber Trunk Dialling," D. A. Barron. Angel Hotel, Brigs. 7 p.m.

I.E.E. (Reading). "Electronics in the Postal Mail Services," G. P. Copping. George Hotel, King St. 7.15 p.m.

I.E.E. (London Graduates and Students). "Magnetic Amplifiers in Power Engineering," M. J. Pope. Savoy Pl, W.C.2. 6.30 p.m.

BIRMINGHAM ELECTRIC CLUB. "The Fuel Cell—A Logical Development in the Conservation of Natural Resources," P. W. Jones. Grand Hotel. 6.15 p.m.

I.E.S. (Bath and Bristol). "Lighting for Production," W. Guscott. S.W.E.B. Demonstration Theatre, Bristol.

I.E.S. (Leeds). "Eye Strain and Glare Disabilities in Relation to Artificial Lighting," G. Black. British Lighting Council, 24 Aire St. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. "50 c/s Single-phase A.C. Electrification on British Railways," J. W. Grève. Electric Hse. 7.15 p.m.

A.S.E.E. (Bristol and West). "Heavy Industry Control Gear." Grand Hotel, Bristol. 8 p.m.

TUESDAY, 22 NOV.

I.E.E. Joint Meetings with Civils. "The Aswan Hydro-Electric Scheme," V. Furuskog and G. F. Kennedy. Gt. George St, S.W.1. 5.30 p.m.

I.E.E. (Electronics and Communications Section). Conference on Electronic Telephone Exchanges until 24 Nov. Savoy Pl, W.C.2.

I.E.E. (N.W. Supply Group). "The Logical Design of Electrical Networks Using Linear Programming Methods," U. G. W. Knight. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (N.E. Graduates and Students). "Operating Mechanisms for Medium Voltage Switchgear," A. Charlton. Sunderland Technical College. 6.30 p.m.

I.E.E. (S. Midlands Graduates and Students). "Automatic TV Assembly," T. L. Harcombe. Training Office, G.E.C., Stoke. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (S. Wales). "Electrical Regulations and Safety in Factories," E. Sutton. Electricity Showrooms, 62 Kingsway, Swansea.

INSTITUTION OF MECHANICAL ENGINEERS (Lubrication Group). Discussion: "Bearing Corrosion." Birdcage Walk, S.W.1. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Western). "Transistors in Control Circuits," E. Wolfendale. School of Management Studies, Unity St, Bristol 1. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Cheltenham). "The Operation and Control of ERNIE." Belle Vue Hotel. 7.30 p.m.

WEDNESDAY, 23 NOV.

I.E.E. (Southern). "Applications of Operational Research Techniques to C.E.G.B. Plant Problems," A. W. Ingram. C.E.G.B. Offices, 111 High St, Portsmouth. 6.30 p.m.

I.E.E. (S.W. Scotland). "A Survey of Street Lighting and its Future," W. R. Stevens and H. M. Ferguson. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. "Blasenn Ffestiniog and Other Medium Head Pumped Storage Schemes in Great Britain," H. Headland. Birdcage Walk, S.W.1. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "Objective and Subjective Requirements for Loudspeakers," F. H. Brittain. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Southern). "Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," J. S. Shaylor. Farnborough Technical College. 7 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Wales). "Radio Navigational Aids in Aircraft." Welsh College of Advanced Technology, Cardiff. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (W. Midlands). Discussion: "The Various Routes to Professional Qualifications in Electronic Engineering." Birmingham University, Edgbaston. 6.15 p.m.

NORFOLK ELECTRICAL CIRCLE. Annual dinner. Flinton Room, Norwich. 7.15 p.m.

THURSDAY, 24 NOV.

I.E.E. (S. Midlands Education Discussion Circle). "The Study of Non-Linear Circuits at Under-Graduate Level." College of Advanced Technology, Birmingham. 6 p.m.

I.E.E. (Rugby Graduates and Students). "Facts on Slots," D. C. MacDonald. College of Engineering Technology. 6.30 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Television Recording: A Survey of the Problems and Methods Currently in Use," J. Redmond. Cavendish Laboratory. 8 p.m.

INSTITUTION OF CIVIL ENGINEERS. Discussion: "The Operation of the General Conditions of Contract for Works of Civil Engineering Construction," Gt. George St, S.W.1. 5.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Sheffield). "The Introduction of Planned Maintenance Systems," A. F. Stedman. Grand Hotel. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Maintenance and Operational Experience of a Data Logging Installation," D. C. Austin. Lecture Theatre, Admin. Bldg., The Associated Ethyl Co. Ltd., Oil Sites Rd, Ellesmere Port, Wirral. 7 p.m.

A.S.E.E. (S. London). "Stage Illumination," F. E. Brown. Greyhound Hotel, High St, Croydon. 8 p.m.

I.E.E. (S. Midlands Graduates and Students). Dinner-dance at The Barn, Hockley Heath. 8 p.m.

FRIDAY, 25 NOV.

I.E.E. (N.E. Graduates and Students). "The Direct Generation of Electricity," B. C. Lindley. Grey Hall, King's College, Newcastle. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. A.G.M. Pepps' Hse, 14 Rochester Row, S.W.1. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (Birmingham). "British Railways Electrification Scheme," W. B. Marrian. Imperial Hotel, Temple St. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scottish). "Instrumentation of a Space Vehicle," Dr A. E. Roy. Glasgow University. 7.15 p.m.

A.S.E.E. (Coventry and District). "A History of Tape Recording," G. Dawson. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy La, Coventry. 7.30 p.m.

MONDAY, 28 NOV.

I.E.E. (Education Circle). Discussion: "Training for Research." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Mersey and N. Wales). "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. A. Setterington. Royal Institution, Colclough St, Liverpool. 6.30 p.m.

I.E.E. (S. Midlands Electronics and Measurement). "Static Switching," G. L. Butcher. James Watt Memorial Institute, Birmingham. 6 p.m.

I.E.E. (E. Anglia). "An Introduction to Electronic Computers," R. C. M. Barnes. Electric Hse, Ipswich. 6.30 p.m.

I.E.E. (W. Utilisation Group). "Discrimination Between h.r.c. Fuses," E. Jacks. S. Western Electricity Board Lecture Theatre Centre, Bristol. 6 p.m.

I.E.E. (N. Staffs). "A Survey of Street Lighting and its Future," W. R. Stevens and H. M. Ferguson. Mechanical Institute, Crewe. 7 p.m.

I.E.S. (Birmingham). "Production of Light Sources," H. R. Ruff. Regent Hse, St. Philip's Pl, Colmore Row. 6 p.m.

Calcutta Electric Supply

Sales Still Growing

THE sixty-third annual general meeting of the Calcutta Electric Supply Corporation Ltd. was held on 10 Nov. in London, Sir Harry Burn, K.B.E., F.C.A., the chairman, presiding.

Here is an extract from his statement: Industry continues to expand throughout the whole of the licensed area and housing development proceeds in Calcutta and its suburbs to remedy the shortage of dwelling space for all classes of the population. The demand for energy grows and I am able to report increased sales to all classes of consumers during the year ended 31 March, 1960. The total energy sold increased by 140 million units to 1,817 million units. The major portion of the increase in demand came from industry.

Energy sold for power purposes refers principally to industrial demand, which accounted for 90% of these sales. The balance covers public water works and domestic power, the latter being mostly for air-conditioning and refrigeration. All the principal classes of industrial consumer recorded higher consumption than in any previous years. The jute industry, our largest consumer, increased their demands by 18 million units to 430 million units.

Further progress in modernisation and rationalisation of jute mill machinery has helped to improve trading conditions for this industry, whose exports were the highest for ten years. Next in importance are rolling mills and engineering workshops, whose consumption increased by

32 million units to 243 million units. Expansion will continue when supplies of steel improve. Of the remainder of our industrial consumers the most important are cotton mills, chemical works and paper mills.

Further expansion took place in the demand for low tension industrial power, sales increasing by 14 million units to 114 million units, and the number of consumers again increasing by over 1,000 to more than 15,500.

The effect of the increase in the demand for energy is shown in the revenue account where it will be seen that the receipts from sales of current have risen by over £700,000 to approximately £9,000,000.

It is proposed to pay a final dividend of 4% (actual) on the Ordinary stock making 7½% (actual) for the year. The net earnings for the year have enabled the company further to strengthen its internal finances and also permit of an increase in the final dividend on the Ordinary stock.

Capital expenditure during the year amounted to £1,160,000 and was almost entirely for our transmission and distribution systems. By far the greater part of the expenditure was on mains and service connections. The forecast of capital expenditure over the next four years based on the anticipated increase in demand indicates an annual outlay of not less than £1½ million on our transmission and distribution systems.

The report was adopted.

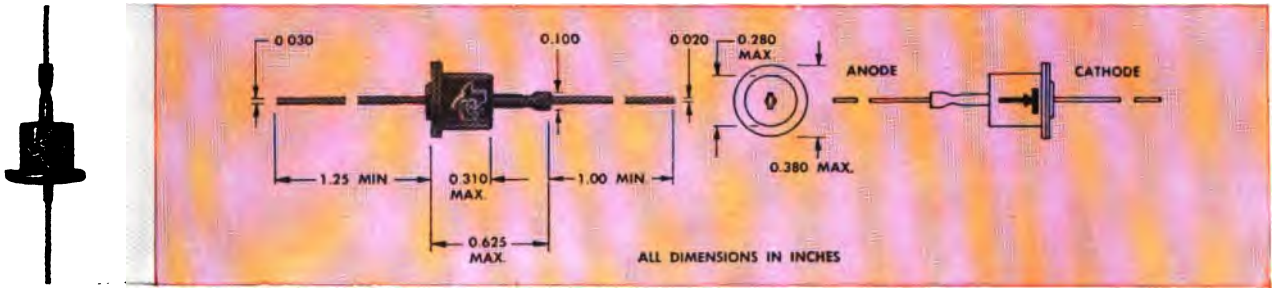
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Average Rectified Forward Current at $+50^{\circ}\text{C}$... I_{O}	750	750	750	750	mA
Average Rectified Forward Current at $+100^{\circ}\text{C}$... I_{O}	250	250	250	250	mA
Recurrent Peak Forward Current at $+25^{\circ}\text{C}$... I_{I}	2.5	2.5	2.5	2.5	A
Surge Current, 1 cycle at 60 c/s at $+25^{\circ}\text{C}$... I_{pk}	15	15	15	15	A
Operating Temperature, Ambient	... T_{amb}	—40 to +100				$^{\circ}\text{C}$



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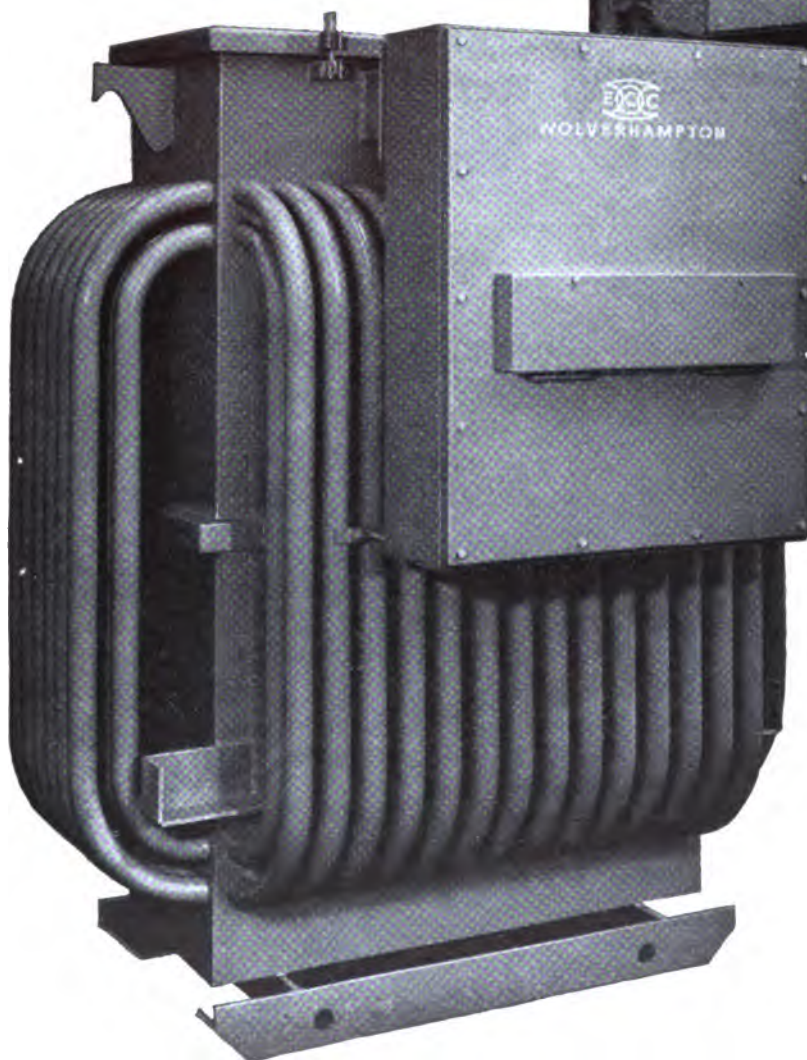
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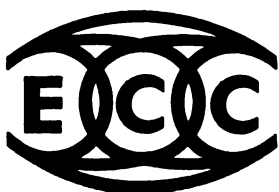
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WOLVERHAMPTON

ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 24 NOVEMBER, 1960

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Comment

SUPPLY ON THE AIR

Use of radio communication by the supply industry has been increasing steadily over the past decade and the general review of the present situation, presented in an IEE paper last week, is timely. It shows that the situation is far from being fully satisfactory. The widespread demand for radio communication facilities makes it difficult for the industry to get anywhere near the facilities it would like for its mobile radio stations and acts as a severe restriction in the technically important field of radio links between fixed stations. In its fight to obtain an allocation of a number of communication channels commensurable with its importance to the country's functioning, the supply industry has been hampered by lack of appreciation of its special requirements, with lengthy messages having to be passed and repeated back, effectively giving continuous transmission when complicated switching operations are being carried out in storm breakdown conditions. Continued pressure by the industry's representatives on the Post Office committee dealing with frequency allocations is producing some improvement in this respect, at the cost of using ever-narrower wavebands for working; but the progress that can be reported in the fixed station communication links is not so impressive. It is most difficult to obtain permission to operate such links in the UK, at least where telephone landlines are a possible alternative; but for some supply purposes radio links have advantages which are quite separate from cost considerations. Because they introduce no appreciable phase shift into signals, unlike landlines, radio links are potentially well-suited to protection schemes working on phase-comparison principles. When the distribution side of the industry is considered, the multiplicity of substations makes radio links potentially more attractive economically than line links for communication, protection and telemetering procedures. In exploiting such possibilities, Britain at present lags behind overseas supply administrations.

DANGER OVERHEAD

Last year, almost one-third of the fatal electrical accidents coming within the jurisdiction of the factory inspectorate were caused through contact with live overhead lines. The typical accident in this category is electrocution of some construction site worker when the jib of a crane comes into contact with the overhead line—or near enough to cause a flashover. Since the lines are clear to see, accidents of this sort should be easily preventable, but because of the rather casual attitude taken to the danger and the lack of appreciation of what constitutes a

safe clearance, fatalities continue to occur. To meet this situation, a specific requirement has been included in the new safety code for the building and civil engineering industries, issued in draft form by the Ministry of Labour recently. Under the code it will be an absolute duty to take all practicable precautions to prevent danger when overhead power lines are near a site. Barriers are means of doing this, as the draft regulation recognises; and such barriers may take many forms, even that of a cradle around the power lines. It is certain, then, that supply engineers will become closely involved in giving advice about implementation of the new requirement. They have been willing to help in the past; but the casual attitude of some contractors to the electrical danger presented by overhead lines has prevented the advice from being more effective. A question for consideration is whether the "practicable precautions" ought to include notification to an electricity board that cranes will be near a line.

STARTING CURRENTS

Starting currents on squirrel-cage motors are a constant subject of concern to installation engineers, even though restrictions on direct-on-line starting are far less stringent than they used to be. The subject is discussed in an article we publish this week on ships' auxiliaries; but the points made have much more general application. The current transient that occurs on transition from star to delta connection when that form of starting is employed is now generally recognised. Its magnitude can easily exceed that which would occur if simple d.o.l. starting were used, but its rather short duration makes it of relatively little importance on systems having reasonable capacity compared with the rating of motor being started. Not so generally recognised is the initial surge of current involved that can occur with auto-transformer starting. The cause here is the magnetising current inrush when the transformer is first excited. In unfavourable circumstances, this can substantially exceed the current that would flow with direct-on-line starting, though, again, the rate of current decrement is high and the transient lasts for only a couple of cycles or so. Practical importance of these excess currents may be relatively slight, but they should be kept in mind whenever the choice has to be faced between simple starting and the use of some reduced voltage device.

CHANGE-OVER COMPLETE IN CANADA

The largest frequency conversion scheme ever: this is but a pale description for the programme completed last year by the Hydro-Electric Power Commission of Ontario. Originally planned to take 15 years, the change from 25 c/s to 60 c/s was finished within ten years. The annual report reviewed this week contains a special account of the work, and this makes clear that one of the embarrassing features was the continuous growth of the system during the change-over. Originally estimated to

cover three-quarters of a million consumers, the scheme eventually involved over one million and, while in the beginning domestic consumers had an average of 2.7 frequency-sensitive appliances, towards the end of the programme this had grown to nearly six per consumer. Not surprisingly, the cost was over double the estimated figure and, excluding the amounts borne by consumers and the municipalities responsible for converting their own distribution equipment, a total of \$352 million had to be met by the Commission. Inevitably, a change-over scheme of this magnitude must bring to light some droll uses of electricity, and perhaps the quaintest was the small motorised door which opened automatically to let a cat out and in, while the most sophisticated was surely the electrical bridge table which shuffled and dealt the cards. With seven million pieces of equipment converted, however, the accent of the scheme must essentially be on its magnitude, and this the report makes plain, but it is modestly reticent on the organisation and swamp change-over techniques that were developed to such perfection that they must remain an outstanding experience of this great standardisation project.

PATH TO PROFESSION

The recent publication, after only three and a half years, of a revision of the IEE's report on the training of graduate engineers is an indication of the speed at which ideas are becoming clarified in this important field. The revised version of the report differs from its predecessor mainly through more explicit recognition that the man who has attained professional academic qualifications will not take too kindly to a dull apprenticeship. He will become dissatisfied if his intellect is expected to mark time while he gains some basic experience. Keep the man occupied mentally as well as physically is the watchword, one which will be appreciated by some who spent their two years of post-graduate apprenticeship a decade or so ago. This thought is carried further by the recognition the report gives to the professional equivalent of training on the job—experience in a staff appointment. This approach is clearly disliked compared with the formal training scheme, but it is one that can certainly work successfully when the senior engineers concerned are willing to spend some time over the training of their junior colleagues. Direct responsibility in such cases can act as a forcing ground of effort and intelligence so as to compensate fully for any gaps left by the relatively haphazard programme necessarily followed. That it should now be sanctioned is one of many recent signs of broader thinking in the continuous concern of the IEE Council to maintain or raise the standards of professional qualification. More liberal thinking about the means to this end rightly involves removing some of the unnecessary obstacles along a path which it is far from easy to negotiate even without them.

Meteore

Motor control gear for alternating current ships

by R. A. F. Craven,* A.M.I.E.E.

PART 2

Requirements for motor control gear for ships having a.c. auxiliaries were discussed in part of the present article, when particular given to specification and selection and to the starter from the aspect of short-circuit. The present, concluding, part deals with and starter performance.

Starter

Limit in the size of motor that can be started and, reduced voltage starting is used. The purpose, to reduce the starting current. Since the squirrel-cage motor remains of prime importance in starting current is achieved by reduced voltage applied at start to the motor rather than introducing slip-ring machines. Most starters are either star-delta or auto-delta it is both interesting and useful to study starting characteristics as distinct from the torque, current, torque and speed relationships. Because we are dealing with the starting of a supply source which is small compared to industrial power supplies, transient phenomena are of little study.

It is straight away that extensive observation of transient currents of high amplitude do not affect the ship's power supply and, if manifest, only in light flicker.¹

Loads

Loads found on board ship do not present any special problems for d.o.l. starters, but reduced voltage must be introduced. Consideration must be given to

It is worth while saying that the International Electrical Manufacturers' classification of standard motor torque, current and speed (A, B, C, D and F) is so important while that it must be hoped that manufacturers will soon follow the limitation it may put on the user and control is very high.

Breakaway, accelerating torques, are important in specifying starting characteristics.

Breakaway is the torque required to overcome the greatest static

* is a director of Watford Electric Ltd. The article is based on a paper given at the Royal Technical Institution, in a series on alternating current auxiliaries. Part 1 appeared in the Electrical Times, 17 November, 1960.

friction that can be expected under the worst conditions (low temperature or inadequate lubrication, for example). *Accelerating torque* is the net torque (i.e. motor torque less the resisting torque of the drive) available for acceleration of the drive and motor rotor inertias. *Peak torque* is the maximum value of any pulsating torque when the motor is running at normal speed.

The main driven loads are centrifugal fans, pumps and compressors and reciprocating compressors.

The three centrifugal drives have similar torque/speed characteristics (torque proportional to square of speed) and the required torques are, in terms of full-load torque (f.l.t.);

Breakaway torque 0.2 to 0.3 times f.l.t.

Accelerating torque 0.1 to 0.25 times f.l.t.

Peak torque 1.0 times f.l.t.

Reciprocating compressors, however, present a more difficult starting problem.

Breakaway torque 1.0 to 1.5 times f.l.t.

Accelerating torque 0.7 f.l.t.

Peak torque 1.3 to 1.7 times f.l.t.

The specified permissible voltage drop determines, as a first step, the maximum starting current or kVA and it is conveniently expressed as a percentage of generator capacity. Although it may be easier to ignore the power factor, it nevertheless does affect the amplitude of the permissible starting kVA and it is certain that the higher the power factor at start, the less the voltage disturbance. Neither auto-transformer nor star-delta starting assist in this respect, but primary resistor starting does and where voltage drop is critical this form of starter, with its inherent ability to give a higher power factor at start, is worth careful consideration.

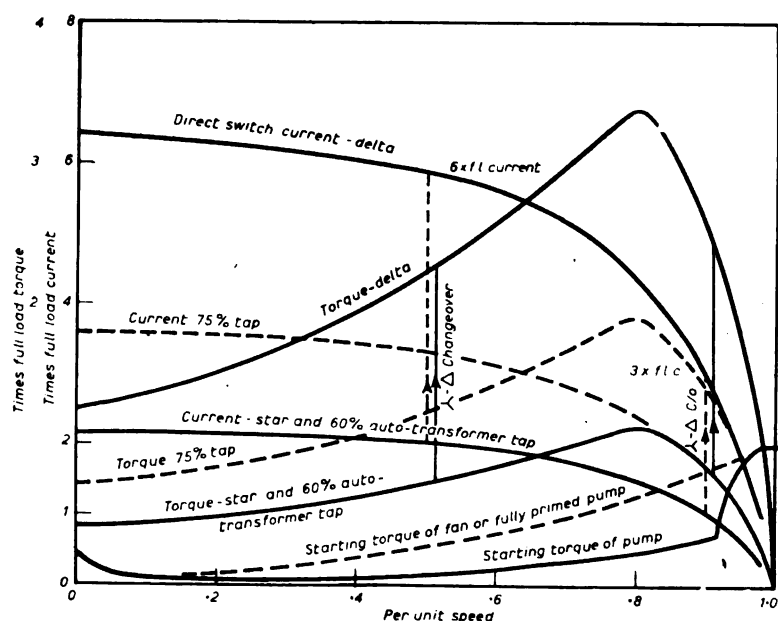


Fig. 6. Variation of torque and current with speed for star-delta and auto-transformer starters

Large motors are unlikely to be started frequently and it has been said that a starting kVA of up to 50% of the generator capacity is acceptable for cargo ships and up to about 20% for passenger ships.¹

Star-delta Starters

Where the breakaway torque is not more than 30% f.l.t., star-delta starting can be used. The torque-speed and current-speed curves for star-delta starting in Fig. 6 are rather idealised pictures of what really happens during the starting sequence, and the oscillogram in Fig. 8(a) is quite typical. The current on closing the star contactor is quite normal; it is 33% of full voltage current. The current should fall to about half this value when the star contactor opens, the motor then ceases to accelerate and when, about two cycles later, the delta contactor closes, a high-peak current appears (the largest peak appears in the red phase in the present example). What happens is that when the motor is disconnected it behaves as an alternator with a decaying field and reducing speed, and the terminal voltage appears as shown in Fig. 7. If the reduction in speed is sufficient, reconnection to the supply (by the delta contactor) may occur when the supply and motor voltages are in opposition and the current rises transiently to a value which may exceed that which would be attained by d.o.l. full voltage start. For comparison, a d.o.l. start of the same motor is shown in Fig. 8(b). If an attempt is made to reduce the transition pause to, say, less than 1 cycle, then there is danger of a short-circuit occurring if the motor is stalled or running slowly; the star contactor on opening may arc for as much as one cycle, which would be quite normal under such circumstances, and the delta contactor on closing would apply a short-circuit through the star contactor arc. The time delay provided by a simple normally-closed contact on the star contactor does not give sufficient interval for the energising of the delta contactor.

The transient torque at changeover will also be very high whenever high current transients are present, but the effect in practice although noticeable from the "thump" that occurs, is not serious.

The star-delta starter provides a convenient reduced-voltage start, and although high current and torque transients do occur at transition, their duration is very short (one or two cycles) and generally the effect is negligible and there is no serious justification for closed transition star-delta starting of the kind provided by the Wauchope connection.

Auto-transformer Starter

The auto-transformer starter is the most-often used of the reduced voltage starters. It provides greater flexibility than

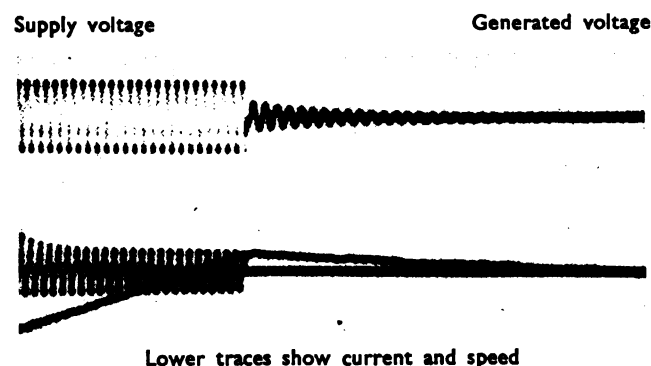


Fig. 7. Voltage appearing at motor terminals immediately after disconnection of motor from supply, as on star-to-delta connection transition during reduced-voltage starting

the star-delta starter because choice of accelerating torque and current is not limited to a single value. An example of a 100 h.p. starter was shown in Fig. 2 on the left-hand side. It is not always clearly understood that the line current and torque are still related directly (neglecting the transformer magnetising current for the moment) and that for 34% of full voltage starting and accelerating torque the line current is roughly 34% of full-voltage starting current, i.e., it would be the same as star-delta. But, of course, whereas it is possible to choose any starting current or torque up to full-voltage values, normally only three auto-transformer tapplings are provided to give 40%, 60% and 75% motor terminal voltage. These tapplings provide 16%, 36% and 56% of the full voltage line current and torque.

Fig. 6 shows the speed-torque and speed-current curves for a motor working on 60% and 75% tapplings. The 60% tapping provides a performance ideally identical to the star-delta start.

Realistically, only the 75% tapping is of positive value; the 40% tapping gives too low a starting torque generally, the 60% could be approximated by a star-delta start. The auto-transformer starter is very necessary for the more difficult starting conditions of high breakaway torque and accelerating torque required by reciprocating compressors.

Transients in Auto-transformer Starters

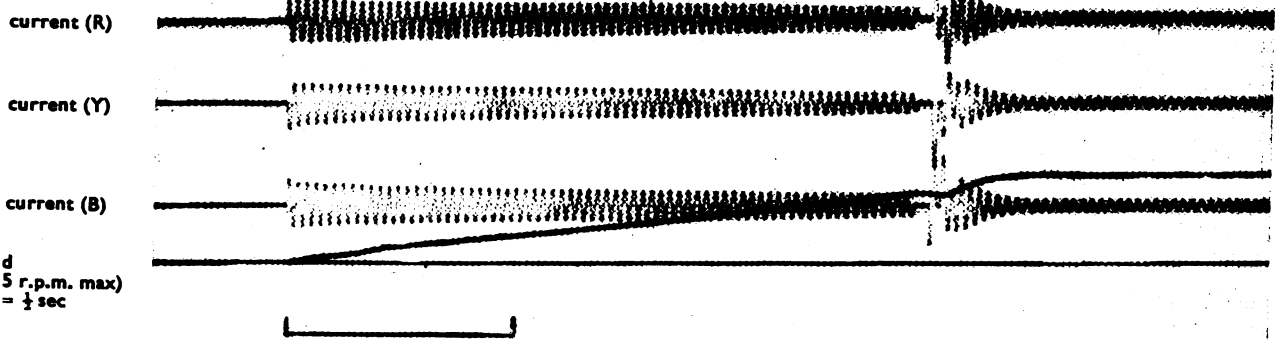
The oscillogram (c) in Fig. 8 shows the transients which can occur during starting. Particular attention should be given to the high peak at the start. What is so often overlooked in discussing this form of starter is the high inrush magnetising current of the transformer. Oscillogram (d) shows the magnetising current of a 40 h.p. auto-transformer. The steady magnetising current is 26 A rms but at switch-on the inrush current is 500 A peak. (The d.o.l. current of a 40 h.p. motor is about 550 A peak.)

The highest magnetising current transient occurs when the switch is closed as the voltage passes through zero and is executing the maximum rate of change. If, at the same instant, the residual magnetic state of the transformer is in the opposite sense, then the magnetising current tends to the limit imposed only by the winding resistance. The phenomenon is very pronounced in motor starter auto-transformers because the designed flux density of the transformer is usually almost at the saturation level (18,500 gauss in the auto-transformer discussed.)

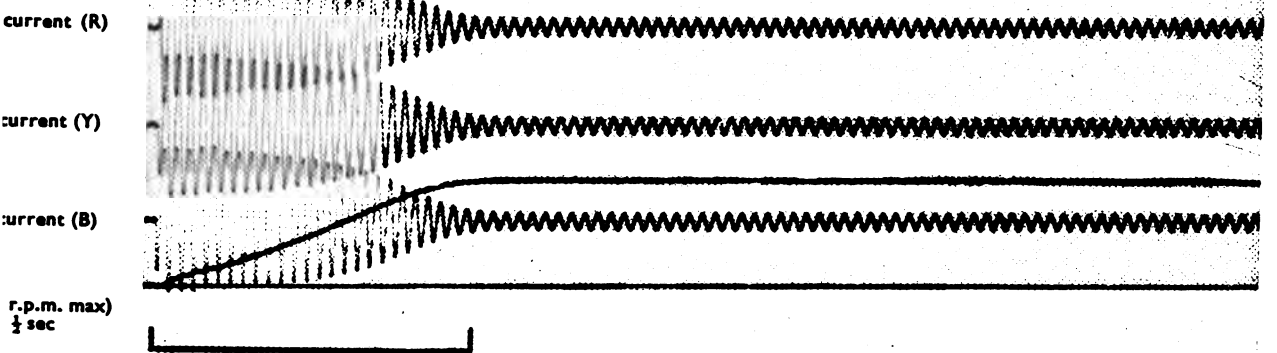
The effect of magnetising inrush current is well illustrated in oscillogram (c), where the primary and secondary currents of the same phase are shown. The secondary current behaves quite normally but the primary current is, in fact, initially very much higher than the secondary current, whereas, of course, it should be smaller. In this particular case, the peak current is 1.6 times peak current shown in Fig. 8(b) for the identical motor started on full voltage. The duration of the transient is quite short (two cycles) and in the example chosen it is one of the most pronounced seen; nevertheless, the phenomenon is always present unless the switching sequence is such that the line and tapping point contactors are timed to close before the star contactor. The inrush current is thereby reduced, but only provided that the impedance of the part of the transformer, which initially behaves as a series reactor, is significant.

The provision of closed transition or the Korndorfer connection is frequently used and this does reduce the transients at changeover from full to reduced voltage running. The example shown is a Korndorfer starter.

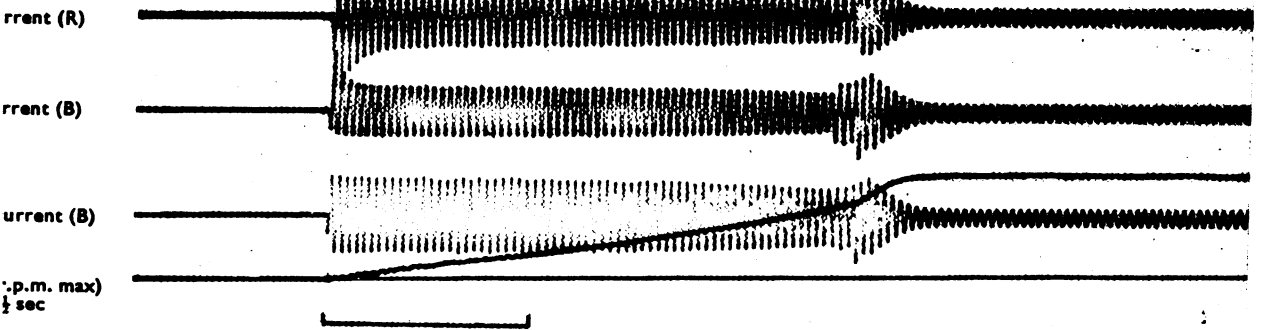
Star/delta



D.O.L.



Auto-transformer
10% tap



Auto-transformer
magnetising
current

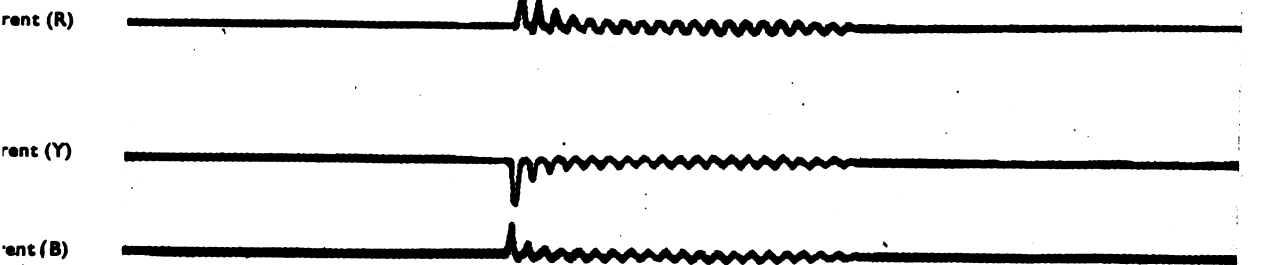


Fig. 8. Current oscillograms for various types of starter during motor starting, showing peaks

Table 1. Comparative Performance and Cost of Starters

Starter Type	Starting current I_s	Starting Torque T_s	Starting power factor	Max. transient current during start I_p	Duration of I_p in cycles	Starting time	Cost †
Direct on line	1.0	1.0	0.4	None*	None*	1.0	1.0
Star-delta ...	0.33	0.33	0.4	1.2	1 to 2	3.4	2.3
Auto Trans.							
40% tap ...	0.2	0.16	0.3	1.2	1 to 2	4.0	2.9
60% tap ...	0.4	0.36	0.35	1.6	1 to 2	3.2	2.9
75% tap ...	0.6	0.56	0.35	1.8	1 to 2	2.0	2.9
Primary Resist.	0.58	0.33	0.8	None*	None*	3.4	2.5

* The asymmetrical current peak at start is not considered. † These are relative costs based on a 50 h.p. starter.

Primary Resistor Starters

For no obvious reason, the primary resistor starter has not been very widely used in this country, but it can provide a very simple and reliable and relatively cheap form of reduced-voltage start.

The starter consists simply of a line contactor, a three-phase resistor bank, a short-circuiting contactor for the resistor, and a timer. The required starting current and torque is more easily accommodated than it is with the auto-transformer starter and there are no transients. There is also the advantage that as the motor accelerates before transition, the terminal voltage increases and so does the torque.

The disadvantage is that the starting torque and current are no longer directly related and, therefore, the starting current for a primary resistance start is somewhat higher than that for an auto-transformer start for the same torque.

Expressed more precisely: with auto-transformer and star-delta starters the line current and starting torque are reduced as the square of (motor terminal voltage/normal voltage), while with a primary resistor starter the torque is reduced as the square of (motor terminal voltage/normal voltage) as before, but the line current is only reduced directly as this ratio.

However, the starting p.f. is somewhat higher and voltage dip during start, which is the true limiting factor, is somewhat less as a result.

There can be no doubt that the primary resistance (or reactor preferably) starter is useful and can certainly be used for centrifugal type drives.

Comparative Performance and Cost

Table 1 brings together many of the important points in starter choice and application mentioned in this article and usefully relates them to cost.

1. References were on page 728 of Part 1 of this article, published in issue 10 November.

(Concluded)

Power Generation and Aswan

TO those unfamiliar with the topography of the Nile basin, the discussions, arguments and delays over the construction of the High Dam at Aswan would seem to centre mainly round high politics and finance. That there might be sound engineering arguments against the construction are, however, apparent from the two papers* read last week before the Institute of Civil Engineers in London by Dr Abdel Aziz Ahmed, D.Sc., PH.D., M.I.C.E., M.I.E.E., who, as former technical consultant to the Ministry of Public Works in Egypt and chairman of the State Hydro-electric Power Commission, has made a close study of the subject.

The old Aswan Dam was built in three stages. The first dam, designed by Sir Benjamin Baker, was subsequently heightened in 1911-12 and again in 1933-34 under the late Sir Murdoch MacDonald. The main purpose was to provide "annual storage" for irrigation, holding back water from the rainy season for use during the dry season, with electrical generation as a subsidiary function. From the generation point of view, the great problem was the comparatively low head and the wide variation in water levels which range from 33 metres (108 ft) down to as low as 3 metres (10 ft) over a 12-month period. After several schemes had been considered, a dual purpose project was finally accepted which comprised seven 47 MW units and two 11.5 MW house sets, all driven by Kaplan high head turbines with an extra 112 MW from low head turbines during the flood period. (Presumably, the fall in head at flood period is through a rise in level below the dam with constant head above.)

The high head station, first part of the project and costing, with its associated civil engineering, some £30m, is now in commission and, when fully operative, will provide 320 MW at summer level, falling to 113 MW at

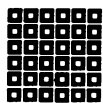
flood. This project forms the subject of a paper read by G. F. Kennedy and V. Furuskog at the Institution last Tuesday, which will be reviewed next week.

Storage from the existing dam, at present levels, is adequate for high and average flow years but is inadequate for low years; consequently, provision must be made for over-year storage. That is the prime purpose of the High Aswan dam project, which it is proposed to erect some miles above the low dam. The Nile basin, however, is mainly superimposed on a sandy terrain with an impervious rock strata which may lie as much as 200 ft below the surface in parts. The area, therefore, forms a vast "sponge" in which oases and swamp areas only retain their water by the surface deposited layers of clay sediment carried down by the river. The river beds, too, are rendered impervious by the same deposits.

Technical objections to the High Dam can, therefore, be lodged on two counts. First, the terrain is not sufficiently stable to support a rockfill dam with an adequate margin of safety where the rock substrata is too deep to provide foundation for a shell-type dam; secondly, the additional hydrostatic pressure by high head storage could well penetrate the thin impervious layer of the river bed and accelerate seepage to a point where the loss would equal the flow. Such conditions have, in fact, been met with in USA where, at Cedar Reservoir, near Washington, seepage was so great that storage had to be abandoned, and similar experiences occurred at McMillan and Hondo reservoirs in New Mexico, Tumalo Reservoir in Oregon and Jerome Reservoir, Idaho.

It is, therefore, quite possible that long-term storage for irrigation purposes would best be served by utilising Lake Victoria and other lakes in the upper reaches of the Niles and their tributaries, with hydro-electric generation considered as a separate project in which pumped storage might be an essential factor.

* "Recent Developments in Nile Control" (6102) and "Storage Losses in the Nile Basin" (6370).



Ontario standardised on 60 c/s

ANNUAL REPORT RECORDS 13% GENERATION RISE

COMPLETION of the frequency changeover from 25 c/s to 60 c/s was completed by Ontario Hydro-Electric Power Commission in July, 1959. Referring to the standardisation, the annual report for the year ended 31 December, 1959, comments that the scheme affected 1 million consumers and required alteration to more than 7 million items of equipment. Total cost of the work was \$352.3 million and it was completed in ten years instead of the 15 originally estimated. Certain industrial consumers are still supplied at 25 c/s, mainly in the Niagara region, where there is adequate generating capacity. Additional security has, however, been provided by installing a frequency changer at the Adam Beck Niagara station.

Gross revenue over the year was 8.3% up on 1958 at \$214,680,399, while the cost of providing service rose slightly more, by 8.8%, to \$211,835,060. General increases in charges were postponed only by withdrawing \$1.2 million from reserves and foregoing the usual provisions for rate stabilisation and contingencies.

Total energy generated and purchased rose by 13% to 35,465 million units, and the dependable peak capacity in December was 6,155 MW. Energy sales rose by 12%.

New Plant

A total of 12 generating units were brought into service during the year and construction was continued on nine projects, five hydro-electric and four thermal. Three hydro stations were completed. These were the 940 MW Robert H. Saunders station, the 45 MW station at Abitibi and the Silver Falls 45.5 MW plant. There are now no further sites capable of sustaining major hydro-electric schemes, but there is possibility for development of 2,000 MW in Northern Ontario at several remote sites in conjunction with base load thermal stations.

Plans for the next five years show 90% of the 2,300 MW to be installed as thermal plant. Hydro plants which have been in service for a number of years were being examined during the year to determine whether they were economically worthy of retention.

Work continued on two 1,200 MW stations under construction, the Richard L. Hearn and Lakeview generating stations near Toronto. One of the generators at the first station was brought into service during the latter part of the year as a synchronous condenser. Work also continued on the 100 MW Thunder Bay station and a site was selected for the CANDU nuclear 20 MW station on the shores of Lake Huron between Kincardine and Port Elgin.

Considerable extensions were made in 1959 to transformer stations and transmission lines. In the southern region, transformer capacity was increased by 1,500 MVA, while in the western and Niagara regions two new transformer stations contributed largely to the 560 MW increase in capacity. A further 1,000 MVA of transformer capacity was also installed in Toronto.

In the southern Ontario region, the length of 230 kV and 115 kV lines was increased by 201 circuit miles, and in Toronto nearly 2½ miles of 115 kV cables were added to the city's distribution system to supply the Terauley transformer station.

Systems Operation

A new control centre was brought into operation at Richview for the western area of Toronto city. The new centre controls load dispatching over telemetering systems. Provision has been made for future installation of automatic equipment for computing where a block of power can most economically be generated, taking into account system losses.

Four of the most severe ice storms in Canada's history occurred during the year and at one time over 100,000 consumers were without supply. Greatest damage was to 230 kV circuits near Orangeville, where an estimated ice load of 25 tons per span formed. The ice was melted by connecting the output of Des Joachims station alternately to each circuit after the lines had been grounded. A current of 1,300 A melted the ice in one hour.

Research

Work on the two half-mile sections of 460 kV experimental line at Coldwater continued with important advances in the prediction of corona loss for different conductor configurations under various conditions of the weather. Tests showed that radio interference performance, assessed from short lines, could be applied to prediction of performance for long lines. Means were also found to differentiate between current leakage losses and corona losses. Operation between 460 kV and 600 kV has been achieved.

Investigations on the performance of air-break switchgear had shown that this type of gear, not specifically designed to function under load and with no rating for switching purposes, was usable instead of more costly switches, provided adequate clearances were allowed.

Systems operational aids investigated during the year were applied to water flow and cable protection. At Niagara, wind changes caused the flow over the falls to alter by as much as 40,000 cu ft/sec. In consequence, there was difficulty in scheduling water flow. Sensitive flow measurements in the river had been made preparatory to designing a computer which will simulate in advance the flow variations in the river.

Two developments applied to cables. A self-regulating rectifier for cathodic protection equipment has been developed for use in districts where stray currents vary rapidly. The equipment has been applied at three points on a 115 kV cable. The second development was a camera for inspecting the inside of 4 in. cable ducts.

PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

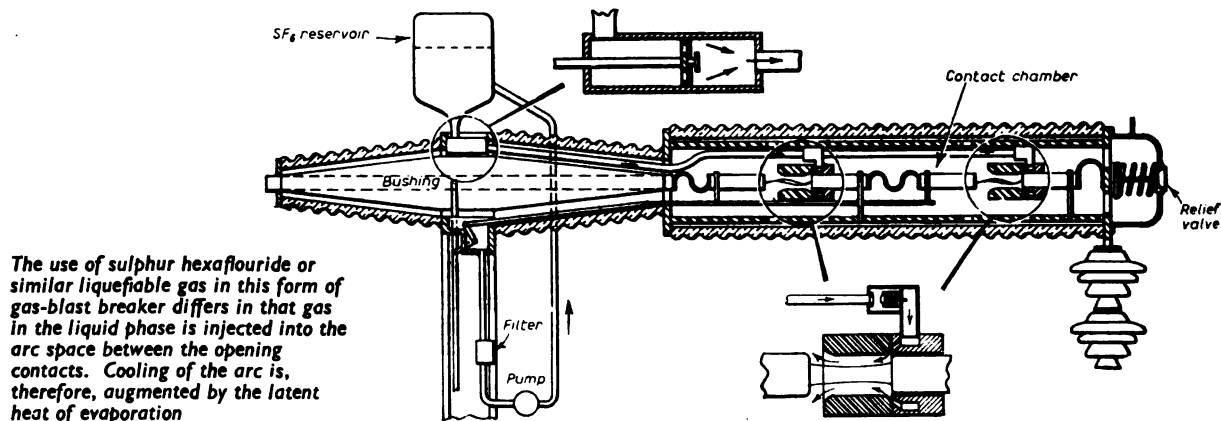
Liquefied-gas Blast Breakers

Among the many principles developed in circuit-breaker design to keep pace with the increasing unit size of generators and transformers has been that of the gas-blast type breaker. A recent phase of development is the liquefied gas breaker in which sulphur or selenium hexafluoride (or other liquefiable gas) is injected between the opening contacts to cool the arc and subsequently maintain an atmosphere of high dielectric strength in their vicinity.

In specification 853,683, the Westinghouse Electric Corp., of Pittsburgh, USA, describes such a breaker in which the gas in the liquid phase is injected between the opening contacts, the latent heat of evaporation assisting in the cooling of the arc. In one embodiment, here shown, the moving and fixed contact pairs, of which there are two per phase, are enclosed within a chamber, the liquid being piped to the contact structure from a main reservoir via measuring piston units mechanically coupled to the contact operating mechanism. Since the boiling point of the gas

Clip-in Diode

Semiconductor-type diodes, for the most part, have followed the basic form of the earlier designs with wire tails or tags for solder or screw-type terminations. That is not to say that other forms are not possible or are undesirable. One variant, for clip connection, is described in specification 853,876, attributed to Sarkes Tarzian Inc., of Bloomington, Indiana, USA. Using the clip-in type cartridge fuse as a model, the assembly comprises a small cylindrical housing terminating in two screw inserts, one of which supports the semiconductor element and the other a spring-loaded device for ensuring good contact with the semiconductor. The element is, therefore, housed in the space between the two inserts bounded by the insulating casing. In an electric circuit, the diode assembly is supported by spring-clip terminals to take the cylindrical outer end of the inserts, which are of different diameters to ensure unidirectional connection. Alternative forms of spring loading for the internal contact are described.



is below normal ambients, the whole system is pressurised. In the reservoir it varies from 20 lb/sq in. to 700 lb/sq in. at ambients between -40°F and $+150^{\circ}\text{F}$, the liquid state in the lower half being maintained by the vapour pressure in the upper half.

Pressure of injection on opening is of the order of 1,200 lb/sq in. falling to around 400 lb/sq in. in the manifold prior to entering the contact space. Passing through the arc, it expands to the vapour phase at around 150 lb/sq in., extracting heat from the arc at the same time. The expanded gas is retained within the contact chamber until extracted, compressed and returned to the reservoir via a compressor unit. To safeguard the contact chamber from excessive pressure rises, a relief valve, set to open at about 800 lb/sq in., is also provided.

Other embodiments incorporate a means for utilising the vapour pressure in the reservoir to operate the breaker mechanism, the use of heat or of a different gas, separated from the vapour by a diaphragm, to maintain vapour pressure in the reservoir and alternative arrangements in which the contacts are immersed in the liquefied gas contained in an enclosing reservoir.

The specification lists boiling points, vapour pressures and relative dielectric strengths of suitable gases.

Alternator Protective System

Modern alternators are often so highly loaded and stressed that additional unbalanced loads or faults current may cause damage, but relays energised through a bridge network of the RL or RLC type from c.t.'s in the alternator circuit and set to operate in response to a negative sequence component of the load current are inherently frequency sensitive. Their operation may be influenced adversely if the frequency should drift from the predetermined value causing spurious operation on the one hand or non-operation on the other. The marginal extra load considered a limit for large hydrogen-cooled units might be exceeded with such protective systems under frequency drift.

In the system proposed by A.E.I. Ltd. and described in specification 853,963, a special alternator, coupled to the rotor of the main unit and with stator windings delta connected across the c.t.'s in the output line, has the rotor winding coupled across the relay. No current flows in the rotor while the stator currents are balanced, but the induced current on unbalance is shown to be independent of frequency.

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C.E.G.B.**network analyser installations****PART 2**

by A. W. Hales,* A.C.T.(B'ham), A.M.I.E.E., A.M.Brit.I.R.E.

THE first of the three articles in this series dealt with general aspects of the CEGB Headquarters network analyser installations and more particularly with the network analyser. This second article discusses those aspects of the a.c. network analyser installation not covered in the preceding article. It also comments in general terms on future network analyser developments, particularly in regard to unevaluated competition posed by the application of digital techniques in power system analytical work.

Instrumentation

The composite equipment constitutes the main source of data from the analyser network and furnishes direct indications of network voltage, current, real and reactive power, and circuit power factor. The schematic arrangement of the overall system as applied to a single analyser channel is shown in Fig. 7. In essence, the system comprises four basic parts:

1. The amplifier input transformers and associated range selection facilities.
2. The voltage and current channel amplifiers and associated stabilised power supply units.
3. The main indicating instruments for voltage, current, real and reactive power.
4. A self-contained phase angle measuring equipment.

The input transformers are wound on Mumetal cores and have single and double screening between sectionalised windings on the voltage and current channels respectively.

The normal transformer secondary voltage input to the voltage channel amplifier for instrument full-scale deflection is 2.5 volts. The corresponding primary winding voltages are 6.25, 15.625, 31.25 and 62.5 volts. Parallel

values for the current channel amplifier are 12.5 millivolts for instrument full-scale deflection with primary winding voltages of 2.5, 6.25, 12.5, 25 and 62.5 millivolts. All the transformers are so designed that their ratio and phase angle errors are not greater than $\pm 0.25\%$ and 15 minutes respectively. The input voltage to the selected current channel transformer is derived from a single 200 milliohm precision shunt inserted in the network.

The voltage and current channel amplifier output voltages corresponding to full-scale deflection on the main instruments are 50 volts r.m.s., whilst the gains of the respective channels are 20 and 4,000. The voltage channel amplifier feeds a load impedance consisting wholly of parallel-connected instrument coils and their associated phase-compensating circuits amounting in all to approximately 4,800 ohms. The current channel amplifier works into a load impedance consisting of series-connected instrument coils and a padding impedance, the latter being designed so that the total load impedance presented to the amplifier is nominally 1,000 ohms. Thus, when the amplifier is operating at nominal rated output voltage the corresponding operating current for full-scale deflection of the ammeter is 50 milliamperes. The padding impedance takes the form of series-parallel RC networks and permits the fine adjustment of the relative angle between the voltage and current channel outputs (± 15 minutes of arc) without producing a significant change in output current magnitude. A vector diagram of the operating conditions of the composite system is shown in Fig. 8.

* Mr Hales is with CEGB Headquarters. Part 1 was published on 3 November.

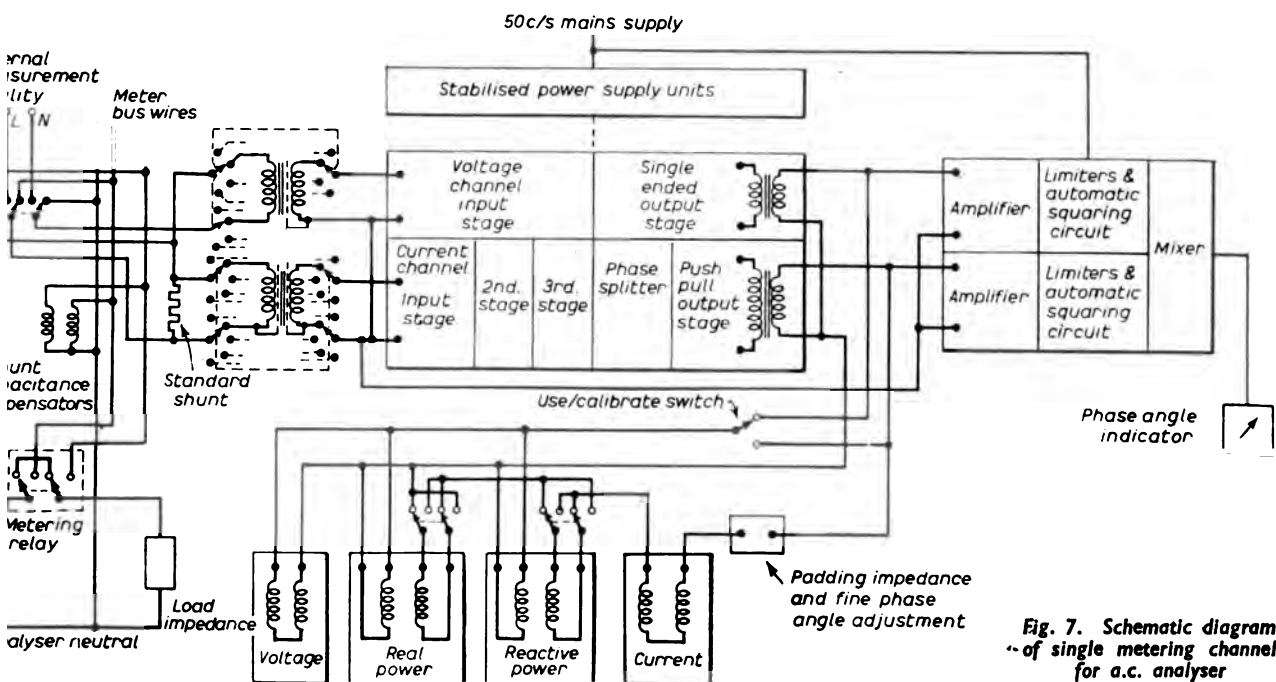


Fig. 7. Schematic diagram of single metering channel for a.c. analyser

The design of the amplifiers, both of which have overall voltage feedback applied, incorporates the following features:

(a) An arrangement of heater supplies which ensures that no cathode-heater centre potential exceeds 2 volts d.c.

(b) Separate heater supplies are provided for each amplifier.

(c) All current-carrying resistors are of the wire-wound type whilst Manganin or Evanohm resistors are used in critical feedback circuits where high and long term stability of performance is required.

(d) A built-in circuit monitoring equipment.

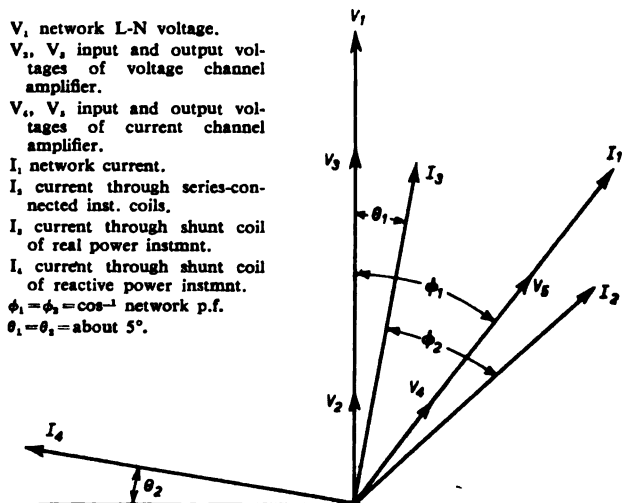


Fig. 8. Vector diagram of operating conditions for main metering equipment

The auxiliary high tension supplies for the amplifiers are derived from two stabilised power supply units having 250 and 400 volts positive d.c. rails respectively. They are of conventional design, the 250 volt line utilising a gas-filled voltage reference tube whilst the 400 volt line uses a primary cell reference source.

The main indicating instruments, i.e., voltmeter, ammeter, wattmeter and varmeter, are of the reflecting dynamometer type calibrated 0—1.25 per unit. The instrument scaling and associated multiplying factors are as follows:

Voltmeter	Scale	0-1.25 per unit			
	Multiplying factors	0.2, 0.5, 1.0, 2.0			
Ammeter	Scale	0-1.25 per unit			
	Multiplying factors	0.2, 0.5, 1.0, 2.0, 5.0			
Wattmeter and Varmeter	Scale	0-1.25 per unit			
	Multiplying factors	0.04,	0.10,	0.20,	0.40
		0.10,	0.25,	0.50,	1.00
		0.20,	0.50,	1.00,	2.00
		0.40,	1.00,	2.00,	4.00
	Total range	0.00-12.5 per unit real and reactive power.			

The voltmeter has a basic sensitivity of 200 ohms/volt and a voltage for full-scale deflection of 50 volts r.m.s. The correct phase and magnitude of the currents in the real and reactive power meter voltage coils are obtained by appropriate internally connected complex impedances.

The initial a.c. calibration of the instruments is carried out using a Shotter-Hawkes comparator of appropriate frequency range, and a variable-frequency power generator. Once this calibration has been established, the corresponding d.c. operating values can be obtained from a d.c. potentiometer. It is thus possible to check the performance of the instruments for stability, etc., by routine d.c. poten-

tiometer checks when necessary. The availability of two precision-grade direct sources of voltage measurement (the voltmeters, which have known correction factors), together with high stability close tolerance load impedances enables the composite equipment to be calibrated on site as occasion demands.

The phase angle measuring facility is a self-contained unit and all-electronic in conception.⁶ It consists of two virtually identical channels which derive their inputs from the voltage and current circuits of the main indicators—the insertion effect being negligible owing to the high input impedance of the channels (approximately 1 megohm in parallel with 20 pF). The first stage of each channel is a conventional RC-coupled amplifier which is preceded (in one channel only) by a “coarse” phase shifting and attenuating network and, in the other, by a “fine” phase shifting and attenuating network. Both these input stages are succeeded by two limiting stages over which automatic mark-space ratio control circuits operate.⁷ The operation of the latter ensures that, over the wide range of input voltage conditions which obtain, a close approximation to unity mark-space ratio is maintained. The square wave outputs of the limiter stages of each channel are fed to a mixer stage—a short-based pentode type valve—the anode current of which is measured by a milliammeter linearly calibrated in terms of phase angle (90° lag—0—90° lead). Compensation of the mixer stage for supply voltage variations and their consequent effect on cathode temperature is achieved by a double diode/resistor combination which shunts the main indicating instrument.

The ordinary mode of operation is such as to give a continuous indication of power factor, though the instrument may be used as a universal phase angle meter with any input of appropriate magnitude and wave form.

When conditions of cross operation exist between the control consoles, i.e., when Channel 1 is selected to Console 2 and vice versa, the metering system of a particular channel is automatically selected to the instruments in the console from which operations are being conducted.

Circuit Instrumentation Scheme

The main instrumentation is inserted at a selected point in the analyser network by means of a system of relays—comprising in all 852 relay units. The relays, which are contained in plug-in cylindrical cans, are of the double-pole changeover type and are fitted with palladium contacts and capacitance splitter plates. The selection of a particular relay is effected by a system of Ledex rotary selectors, each relay being selected by a code word comprising five characters. The structure of the code word is shown in Table 2.

Table 2. Build-up of Circuit Selection Code

Character No.	1	2 *	3	4	5
Specified Function	Channel Selection	“Unit Type” Selector	10's digit	1's digit	Unit circuit position
Possible Values	0-2 inclusive	L, M, G, AT, CT	0-9 inclusive	0-9 inclusive	1-4 inclusive

* L, Line impedance unit; M, Load impedance unit; G, Generator unit; AT, Autotransformer unit; CT, Coupling transformer unit.

The logical design of the channel selection scheme provides that any channel-control console combination may be selected with the exception that it is not possible to operate two consoles in one channel simultaneously. When this latter condition arises an audible alarm is given and relay operation is prevented. For the selection of a particular relay, the character numbers 1—5 are operated sequen-

s. 1—4 are self-explanatory, but No. 5 unit position selection is not so, the selection here upon—

he type of unit selected,

circuit position required in (a).

ase of generator and load impedance units only t position is required (No. 1), whilst in the case nsformers and double-wound transformers two are required (Nos. 1 and 2). Line impedance ever, have the maximum of four possible points ement when used in a π -configuration, i.e., Nos. 1 4.

r Control Consoles

ine data from the analyser is obtained at either f the control consoles (one shown in Fig. 9), to circumstances, the equipment being operated e analyser for especially large network studies separate analysers for systems of reduced com- n addition to circuit selection facilities, the ontain the main instrumentation indicators—the hich are visible through apertures in a masked :l which forms the horizontal surface of the

ection facilities when correctly operated permit- tion of an individual metering relay, which main instrumentation at a chosen point in the The range-change facilities of the voltage and annel amplifiers are also remotely controlled e points and visual indication of selected range : for voltage, current, real and reactive power d. A remote control feature for main power also included. Both consoles have self-contained for the continuous measurement of circuit tor.

tion and Interconnection Field

tre section of the main analyser is used for the n of all units, the terminations being colour- and y-coded according to unit type, function, etc. used as a field for the assembly of any desired The latter facility consists of rows of plugs inter- so that adjacent sockets, when inserted, are ally connected together. A vacant plug position ighbouring bus sockets isolates them one from Designation strips are provided for the identifi- system locations.

's Interconnection Cables

m of cable for main 1,000 c/s interconnections varies according to the type of functional unit. l, generator units employ polythene-insulated reened feeder, load impedance units polythene- twin-screened feeder, and the remaining units edance, autotransformer and coupling trans- x-core polythene-insulated p.v.c.-sheathed multi- , each core being individually screened. With the rangement all screens are operated in an isolated The cabling at the rear of the termination panel is in 70/0076 silk-covered cable—each cable ntained in position by a weighted pulley. The f this cable was determined largely by mechan- than electrical considerations. All cables are l with appropriate plug-socket components to lismantling of the equipment.

Power Supplies

upplies are located in two racks adjacent to the a front view is shown in Part 1, Fig. 6). The

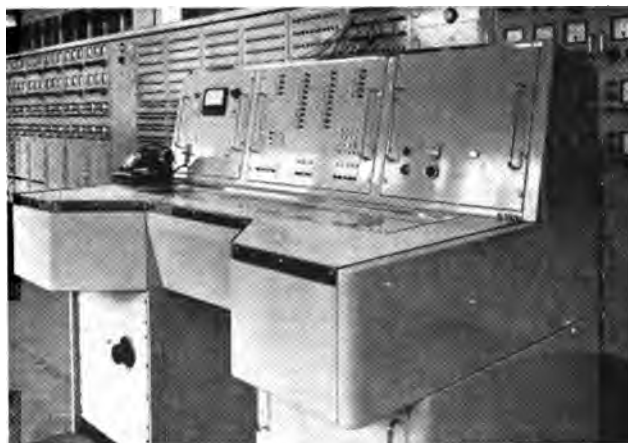


Fig. 9. One of the two control consoles for the a.c. network analyser

mains supply to the analyser is at 415 volts three-phase 50 c/s, being remotely controlled by a solenoid-operated air circuit-breaker which feeds a main distribution board for the whole equipment. Ordinarily, the circuit-breaker is automatically controlled by a time switch which operates according to a specified schedule. Complete voltage and current instrumentation for the mains supplies is provided, together with an audible low-frequency alarm which can be adjusted to operate in the frequency band 47-51 c/s. Auxiliary d.c. supplies for the analyser are derived from three constant potential metal rectifier units; these provide the following:

- (a) A 50 volts general indicating lamp supply.
- (b) A 24 volts relay operating supply.
- (c) A 50 volts automatic circuit selector operating supply.
- (d) A 50 volts oscillator oven heater supply which is without time switch control.

The rectifier for supplies (c) and (d) above, which has a normal output voltage of 50 volts and a power rating of 600 watts, possesses good regulation characteristics which are necessitated by the relatively high peak currents taken by the circuit selectors when simultaneous operation occurs.

The primary 1,000 c/s a.c. source for the excitation of the analyser network is an oscillator unit based on the shunt-fed Hartley circuit comprising two stages (1), the oscillator maintaining circuit, and (2), the cathode follower output stage. Its frequency stability is better than 1 part in 100,000 and its short-term amplitude stability is better than 1 part in 1,000. All auxiliary supplies are stabilised so as to ensure a consistent high level of stability over the normal range of supply voltage variations. The oscillator frequency-determining network is located in a thermostatically controlled oven in which the temperature is maintained normally at $86.5^{\circ}\text{F} \pm 1^{\circ}\text{F}$. The total operating cycle for the oven heaters, which dissipate approximately 45 watts occupies 13 min of which 4.5 min is heating time. Fine adjustment of frequency is provided by a variable capacitor which gives a total range of adjustment of $\pm 0.1\%$ of normal frequency. The output voltage of the oscillator is approximately 9 volts r.m.s., the total harmonic content being 0.4%.

The output of the oscillator is fed to a composite unit consisting of:

- (a) A single- to two-phase conversion unit.
 - (b) A valve voltmeter.
 - (c) A frequency comparator unit.
- (a) Comprises tandem RC coupling networks associated with a single-stage feed-back amplifier. Two outputs are available, an "in phase" and "quadrature" respectively,

both of which are independently variable in magnitude, with the latter also variable in phase. The normal output phase voltage is 8 volts r.m.s. The valve voltmeter unit (b) above, is associated with (a) and is normally connected so as to monitor all important 1,000 c/s voltages in the supply equipment and adjust the voltage levels in the supply chain to their nominal working values. Provision is made for the instrument to be used external to the equipment when required. Self-contained d.c. circuit monitoring equipment is also included to facilitate fault localisation.

The frequency comparator unit is used to compare the locally generated 1,000 c/s oscillator signal with that of the GPO standard 1,000 c/s tone. Though the necessity for frequent checking does not arise, owing to the inherent high frequency and output stability of the oscillator, this facility provides a means of accurately ascertaining frequency errors or drifts that may arise during long periods of operation. Basically, the comparator consists of a parallel-T bridge network having single-stage amplifiers on each input; the output which is to be compared being taken from the mid-point of one bridge section and fed to a two-stage amplifier which has a cathode follower output stage in the cathode circuit of which is connected a moving coil rectifier instrument. This instrument, in addition to being used as a "beat" indicator, is also used as the valve voltmeter indicator. The composite chassis containing these three units is supplied from a common stabilised power supply unit of conventional design.

The two-phase voltage output from the phase conversion unit is fed to two separate but identical amplifiers which provide a source of two phase power for exciting the parallel-connected Magslip resolver stators of the 32 generator units. These amplifiers are mechanically identical with those used for the generator unit main amplifiers, but differ electrically in certain respects, the open loop gain being of the order of 1,600. Their load is of a predominantly inductive character amounting to some 3.5 VA at approximately 0.30 power factor lagging, the supply voltage level being 20 volts r.m.s.

Operation and Maintenance

The network analyser facilities form a sub-group of the analytical group of the Transmission System Design and Development Section at the Board's headquarters and are operated by a nucleus of engineers who are responsible for the co-ordination of all studies undertaken.

To assist in the efficient assembly of study data and execution of studies, a comprehensive range of standard forms has been evolved. These cater generally for the commonly encountered types of study and range from standard load and generation data schedules to synchronous machine performance charts, etc.

CONTRACTORS

A list of the principal contractors concerned with the execution of various aspects of the a.c. network analyser project is given below:

Nash and Thompson Ltd. ...	Functional unit manufacture and overall installation.
Elliott Brothers (London) Ltd.	Main instrumentation equipment.
Salford Electrical Instruments Ltd.	Panel instruments for functional units.
Alfred Imhof Ltd.	Racks and consoles.
R. Seifert and Partners ...	Architects and heating and ventilating consultants.
Thermocontrol Installation Co. Ltd.	Air conditioning plant.

The maintenance of the equipment is essentially preventive rather than curative, routine checks being carried out in accordance with a pre-arranged maintenance schedule based largely on operational experience to date. With the comprehensive monitoring facilities embodied in the equipment, rapid fault location is readily achieved.

The Future

Though the present equipment may be regarded in some ways as being in a primary phase of development, it has been designed so as to enable the ready integration of further ancillary equipment which would enhance its performance, e.g., an automatic network-balancing feature applied to generator units designed to maintain generator output conditions at a pre-determined level under widely differing terminal impedance conditions. The feasibility and desirability of proceeding with such a scheme is, however, necessarily the subject of a separate investigation, since due regard has to be paid to the economics of such a feature, and developments in other and more rapidly developing spheres of computer activity.

The application of pure numerical methods to power system analysis has assumed considerable importance with the more widespread use of digital computers and their associated techniques. Many works have already been published which deal with the various techniques employed in the solution of the more numerous types of study that are commonly necessary.^{8,9,10} The existing digital computer installation (Deuce)¹¹ at the Board's headquarters, has been and continues to be used for routine studies for which programmes of a useful commercial character are available. The development of others to extend its sphere of application will doubtless occur. This computer may be regarded as complementary in character to the network analyser, providing a valuable supplementary channel for studies which cannot, for various reasons, be accommodated on the network analysers at a given time.

The advantages and disadvantages of the network analyser as against the digital computer have already been the subject of much comment, and as would be expected, there are many points which can be advanced to justify both methods of approach. However, on a time and economic basis (and the two are intimately related) an adequate comparison of studies effected by the two methods has not been made, so far as is known. Clearly, controlled tests are necessary to evaluate the relative effective times and economic merits of each method, and until such time as reasonable quantitative evidence is available, the subject must remain speculative in character. It is sufficient to say that the digital computer method is potentially faster in so far as the computation element is concerned, but the overall time expended is governed by other factors of a non-technological character which rapidly reduce the significance of any variations that occur in actual computing time. Because of this the overall procedure can show the network analyser to considerable advantage at least in respect of time.

As far as network analysers are concerned, by further development their speed of operation could be made to eclipse anything that has been achieved to date. To this end, one may quote as an example the application of a system of digital instrumentation with which is associated a digital read-out-print-out facility used in conjunction with a high speed network instrumentation scanning system. Though this and other ancillary features could be successfully exploited and a consequent increase in the speed of operation achieved, it is difficult to imagine that this course could be followed in present circumstances.

y having regard to competition in the digital s important to remember that in making an of the relative merits of the network analyser al approaches to power system studies, the at a serious disadvantage in that it has not been t of intense design and development work as with the latter.

from the economic aspect, there is another, he educational one, which cannot be over- in assessing the relative merits of the two classes ment. Potentialities of network analysers in the d field, whether in formal education or otherwise, erable, and they provide an essentially practical of what are, to many people, purely theoretical superficial phenomena.

(To be concluded)

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ew Design for Underground Stock

3 "silver trains" are being added to London ntransport's underground services, this time on the ine. They are three of an experimental proto- first having come into service on 9 November, 1 train is made up of four motor cars, of entirely n, and four trailer cars converted from earlier Line stock. The new trains will supplement the rvice and at the same time provide information general suitability of the design in operation.

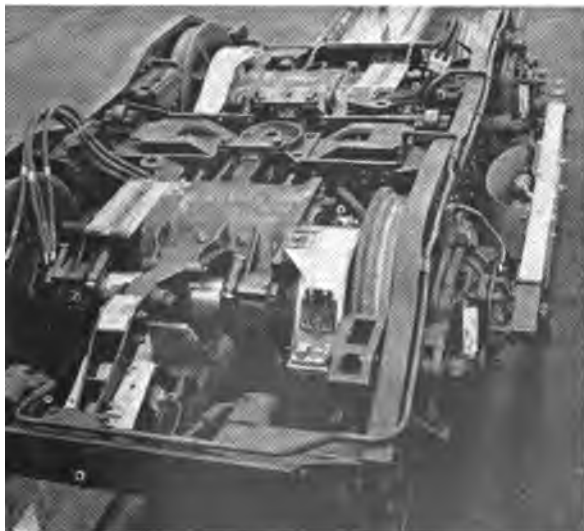
and Control

ost distinctive feature of the new motor cars, n wide vista windows and the sloping-fronted 1 alloy coachwork, is perhaps the spoked wheels gies. Contrary to previous design practise, both ach of the two bogies are motor-driven. Motors 60 h.p., 300 V, nose-suspended, and each is tly connected together in series. Precaution heel-spin of individual axle units is achieved cting a two-coil differential relay across each ir. Wheel-spin sets up out-of-balance voltages ay which trips the line circuit-breaker causing d lever to return to zero.

Control is by series-parallel operation of the two bogie motor-pairs effected by AEI camshaft type equipment. Although speed characteristics of the new trains have been deliberately matched with those of existing stock, improved performance is manifest in the reduction of current consumption for a given acceleration. This has been achieved by the use of higher motor field flux densities.

Lighting Supplies

Main lighting is by 4 ft, 40 W fluorescent units working at 115 V, 850 c/s. Supplies are obtained from the secondary of a step-down transformer fed by a 220 V, 850 c/s single-phase motor-alternator. A separate winding on the transformer provides auxiliary supplies at 50 V d.c. for battery charging, control, brakes and doors, via a germanium full-wave bridge rectifier. This differs from previous London Transport practise where auxiliary supplies were obtained direct from a motor-generator and supplies for lighting from a 115 V, 850 c/s alternator coupled to the same shaft. In the new trains, standard tungsten filament emergency lights are replaced by fluorescent lamps, their supply being derived from battery-fed transistor inverter units.



bogies for the new stock incorporate the first 300 V motors to be used by London Transport. Both axles on the bogie are motored. Right, car interior showing fluorescent lighting



Fig. 1. Coolkeeragh from the south showing the 110 kV substation and 60 MW extension under construction

ULSTER'S first oil-burning station was opened at Coolkeeragh, five miles north east of Londonderry, by the Princess Royal on 1 November. When completed, the station will have a capacity of 180 MW with provision for later extension to 360 MW. Estimated cost for the completed 180 MW section is £13.5 million.

Two main considerations influenced the choice of oil rather than coal as fuel. Overland freightage rates for coal delivery would have increased costs considerably, especially since the River Foyle, on whose banks the station is built, has sufficient depth to allow 18,000-ton ocean-going tankers to unload at an off-shore jetty.

Construction

Coolkeeragh has two 30 MW sets in operation and the first of two 60 MW sets is scheduled to come into service during the winter of 1961. The second 60 MW set has received approval and will be commissioned in 1963.

Unit boiler-turbine construction has been used and the generators are arranged transversely in the station, south of the unit boilers. The turbine auxiliary switchgear is housed in an annexe on the south side of the station, and the boiler auxiliary switchgear in a similar annexe on the north side. Mechanical auxiliaries are located in the basement. To the east of the station, a separate building contains the demineralising water treatment plant and fuel oil handling pumps. It also houses a small standby boiler.

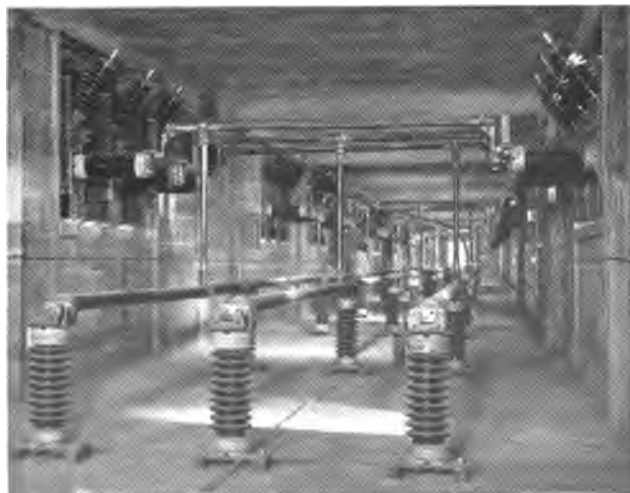


Fig. 2. 33 kV busbar installation in the switch-house adjacent to the control room, showing isolating switches

Coolkeeragh

ULSTER'S FIRST OIL-BURNING STATION

Coolkeeragh is connected to the 110 kV distribution system through an outdoor switchgear compound on the south side of the station. The station also provides electrical power, process steam and demineralised water to chemical works nearby. These two factories produce neoprene-rubber and calcium carbide and take their supply at 33 kV through an indoor switch compound on the south side of the station adjacent to the electrical control room.

Fuel Oil Handling

The fuel handling installation is designed to operate with self-unloading tankers. A pipeline with a 750 ton/hr capacity links the offshore jetty with five 7,500 ton storage tanks. Transfer pumps feed the oil as it is required to four 150-ton "ready for use" tanks associated with Nos. 1 and 2 boilers. A further two 200-ton tanks will be constructed for No. 3 boiler. All oil pipes are heated by steam tracer pipes and lagged. An auxiliary 10 klb/hr boiler provides steam for heating these pipes when the main boilers are out of service.

Boiler Plant and Turbo-alternators

The three boilers in the first section of the station are of the single-drum radiant type. Each has duplicate i.d. and f.d. fans, duplicate air heaters and a single economiser. The 380 klb/hr boilers have automatic retractable fuel burners. Fuel oil is supplied to each of these boilers by duplicate 100% duty variable-speed pumps drawing oil from the "ready for use" tanks. For the third boiler, three 50% duty constant-speed pumps are to be installed.

Each boiler has supervisory control from separate panels on the operating floor between turbine and boiler houses. The boilers have electrically operated and remotely controlled soot-blowers of both the fixed and rack types.

An unusual feature of the station is the provision for supplying process steam to the nearby neoprene factory. A small auxiliary back-pressure turbine supplies steam to the factory at 200 lb/sq in. through a 4,000 ft long, 18 in. diameter pipeline. The back-pressure alternator is rated 2.26 MW and is connected to the station 3.3 kV auxiliary services board. For standby use, the process steam can be alternatively supplied through a pressure-reducing valve from the 625 lb/sq in. steam main and two desuperheaters. These desuperheaters are also used when the steam is passed through the back-pressure turbine.

The two turbines installed in the first section of the station are two-cylinder impulse reaction machines rotating at 3,000 r.p.m. They each have 34 stages with double exhaust, low-pressure cylinders. The twin condensers are designed to maintain a vacuum of 29.07 in. of Hg at the

nomical ratings of the sets, that is, 24 MW. The s are rated 37.5 MVA at 0.8 power factor and n and pilot exciters shaft driven. Air is circulated a closed-circuit system in each machine by twin y fans. The turbines are normally lubricated by iven pump, but auxiliary steam-driven pumps are ided. The third turbine will have 24 stages and the will maintain 29.07 in. of Hg vacuum at 48 MW. economical loading, or 28.9 in. at the 60 MW will be hydrogen-cooled with circulation by a en fan. All the condensers have cathodic protection.

nd Circulatory Water

ed water system has to meet the requirements the power station boiler make-up and also the eoprene factory. The demineraliser plant has a put of 18,000 gals/hr with provision later for s capacity. The demineralised water for the stored in rubber-lined tanks. Stainless steel, twin ty pumps convey it through a 3,000 ft long aluminium pipeline to the factory.

ater for the first two boilers is circulated by three r pumps driven by 625 h.p. 3.3 kV squirrel-cage itable for direct-on-line starting. There are also two 330 klb/hr steam-driven pumps. The feed arranged so that one electric motor-driven pump steam-driven pump supply each boiler, while the motor-driven pump is available for standby. boiler will operate on a similar system. It will 660 klb/hr pumps driven by 1,300 h.p. motors 0 klb/hr steam-driven pump. Each boiler has five feed heating with the three final stages on the side of the feed pumps.

ing water is drawn through twin culverts from 400 ft offshore. Four 13,000 g.p.m. vertical shaft ving Nos. 1 and 2 machine condensers are driven p. 3.3 kV motors. A further two 25,000 g.p.m. iven by 295 h.p. motors will supply condensers rd machine. After discharge from the condensers, enters syphon pits before returning to the river ft downstream. Three additional pumps supply m. to the neoprene factory.

rmers and Switchgear

ain generator transformers for Nos. 1 and 2 are rated 37.5 MVA, 3 ph, 11.8/33 kV and are led. No. 3 generator transformer will be rated 3 ph with a ratio of 11.8/110 kV. The main

Station Plant Details	Units	First Section	Second Section
Boiler Plant			
Number of units		2	1
Rating	klb/hr	380	550
Stop valve pressure	lb/sq in.	625	950
Stop valve temperature	°F	850	925
Feed water temperature	°F	340	385
Number of fuel burners		15	8
Turbo-generators			
Number of units		2	1
Output	MW	30	60
Vacuum	in. of Hg	29.07 at 24 MW	29.07 at 48 MW
Number of stages	H.P.	22	18
	L.P.	12	12
Condenser surface	sq ft	27,000	47,000

switchgear is of the pneumatically operated, low-oil-content type and the switchyard is arranged as a double busbar outdoor installation. The same type of switchgear is used for the 33 kV output from Nos. 1 and 2 machines but it is located in a switch-house to give protection from fouling by salt spray and carbide dust. Main transmission from the station is by 110 kV overhead lines, but a 33 kV cable carries supply to the nearby chemical factories and an alternative supply may be obtained for them from a 45 MVA 110/33 kV transformer.

Station auxiliaries are fed either through air-break switchgear for 3.3 kV motors or through 400 V grouped starter boards. Three 5 MVA 33/3.3 kV transformers provide the auxiliary supplies.

Consultants: Kennedy and Donkin, and Sir Alexander Gibb and Partners.

MAIN CONTRACTORS

Civil engineering works, roads and super-structures	Sir A. McAlpine & Son and Farrans Ltd.
Structural steelworks	Harland & Wolff
Chimneys and civil engineering works ..	Tileman & Co.
Steam boilers Nos. 1 and 2	Clarke, Chapman
Turbo-generators Nos. 1 and 2 and 400 V switchfusegear	English Electric
Back-pressure turbo-generator, generator transformers and main and auxiliary cables	AEI
Feed, and circulating water pumps	Mather and Platt
Circulating water pipework and valves ..	Aiton
Factory circulating water pipework	Shaw-Petrie
Auxiliary boiler	Davey, Paxman
Auxiliary pumps	Gwynnes Pumps
Electrolytic protection	Cumberland Engineering
33 kV and 3.3 kV switchgear, and main generator connections	A. Reyrolle
Interbus and station transformers	Brush Electrical
400 V contactor switchgear	Brookhirst Igranic
Auxiliary transformers	South Wales Switchgear
Metering equipment	Landis & Gyr
110 kV lines	J. L. Eve Construction

Two new sets, now with, n, the MW sure sing t sup-auxil-ocess earby ictory



OVERSEAS NEWS



from our correspondents abroad

CANADA

Columbia River Finances

Precise stipulation of the terms on which the Federal Government would grant aid to British Columbia for the \$460 million Columbia River development project have been requested by the BC Premier, Mr Bennett.

He has asked for the maximum amount the Federal Government would be prepared to lend the BC Power Commission, whether the Federal Government would require an unconditional guarantee of the loan by the BC Government, the interest rate to be charged based on today's prices and the terms of any loan which is likely to be realised. Mr Bennett also pressed for the amount of any outright grant which the Federal Government is likely to make. Grants have been made in the past to other Canadian projects but Federal officials have so far implied that the Columbian Power System would need to be self-liquidating through sale of power to BC consumers and that, therefore, the Federal Government offer would be in terms of a loan rather than a grant.

Claim Against Ontario Hydro

An appeal to the Supreme Court of Canada by the Upper Ottawa Improvement Company will be based on French laws relating to floating on rivers which date from the fifteenth century. The company is claiming \$1 million damages against Ontario Hydro, because they say that logs delivered by them to paper companies downstream now have to be towed, whereas before the rivers were dammed they floated with the current. A previous claim lodged in May, 1958, has already been dismissed by the Ontario Supreme Court and the Court of Appeals. Ontario Hydro argue that public right to float logs does not imply the right to use the current of the river.

Third Nuclear Station

Design studies for a nuclear station with a 40 MW heat rating are to be undertaken by Atomic Energy of Canada. Expenditure at the rate of \$100,000 per month for the next six months is envisaged and contract negotiations are well advanced for the initial stages of the new study to be carried out by Canadian General Electric. Before a decision to build such a plant costing

from \$15 million to \$20 million is taken it would require approval by the Federal Government. A reactor using natural uranium as a fuel and an organic liquid moderator is likely to be selected.

TV for Crane Safety

Closed-circuit television cameras are being used experimentally to assist large-crane operators. The cameras give the crane operator a view of what might be in the path of the jib and also help him to manoeuvre the crane without relying entirely on hand signals from ground level. The installation is on one of the large derrick cranes aiding dam and power station construction at Otter Rapids. Construction work on the Otter Rapids Dam has now passed the half-way mark and it is scheduled for completion by 1963. By that time, 172 MW of generating plant will be in operation.

British Tenders for Toronto Subway

Three British firms were among those tendering for between 40 and 50 subway cars for the Yonge St section of the Toronto subway which is now under construction. The contract, worth \$5 million, has been tendered for by the Birmingham Railway Carriage and Wagon Co., Metropolitan Cammell Carriage and Wagon Co. and the Gloucester Railway Carriage and Wagon Co. These companies face stiff competition from three Canadian firms and also one US, two Japanese and one West German company. It will be some weeks before the successful bid is announced.

Locomotives for New Zealand

Contract for 12 diesel electric locomotives for the New Zealand railways has been awarded to the Canadian firm of General Motors Diesel Ltd. The locomotives are priced at £840,000 each and will operate freight trains on the Napier and New Plymouth lines. They will replace some of the existing oil-burning steam locomotives now nearly 30 years' old.

U.S.A.

UK Turbine Tender Allowed

Opposition to acceptance of a British tender for a 500 MW turbo-alternator on the grounds of national security has been overruled by the Director of the Office of Civil and Defence Mobilisation. The tender for a set to be installed by the Tennessee Valley Authority was sub-

mitted by C. A. Parsons, more than a year ago (ELECTRICAL TIMES, 12 March, 1959). Valued at nearly £4½ million, the tender was about £2 million lower than tenders submitted by US companies. American GE and the Westinghouse Corp. objected to Parsons' offer being accepted because, they said, import of such machines endangered national security. The inquiry has taken nearly 20 months and during that time a protest by the Prime Minister was made to President Eisenhower against protectionism.

Announcing the decision to allow the contract Mr Hoeg, the Director, said the question of national security may need to be reviewed if foreign makers increase their share of the market. Some members of Congress have been demanding a complete ban on electrical imports.

BOLIVIA

Santa Cruz Power Plant

Tenders for installation and operation of an electric power plant for Santa Cruz are requested by the Public Works Committee. The successful tenderer will have to finance the whole undertaking and fix consumer tariffs. An additional 5 MW of plant is required to supplement existing capacity of a 1.65 MW diesel installation. It is intended that the new plant shall be operated in conjunction with the existing plant. The successful tenderer will also be required to study hydro-electric development in the area. Applications should be made, preferably in Spanish, to Comite de Obras Publicas de Santa Cruz, Propuesta a la Convocatoria a Propuestas No. 2/60 Casilla No. 218, Santa Cruz de la Sierra. The closing date for tenders is 7 Jan., 1961.

POLAND

Emphasis on Exports

The Polish Ministers of Heavy Industry and Foreign Trade have decided to devote increased attention to improving export of engineering and electrical products. The draft of the new five-year plan to 1965 envisages an increase in export of machines and equipment to 2½ times the present value. Recently three-year trade and payment agreement was concluded between Poland and the United Arab Republic. In exchange for electric motors, measuring and controlling equipment, diesel engines and other

products, Poland will receive UAR cotton, manganese ore goods. A comment on trade can countries was made in a speech by the Deputy Minister of Trade. He said that in addition to the relations established with the Sudan some years ago, and recently developed trade with Tunisia, Guinea and

GHANA

Smelter Agreement

Agreements for the Volta dam and power project, which will include an aluminium smelter to be built by the Valco consortium, were signed by Mr Edgar Kaiser in Accra on Thursday. The Valco consortium present consists of Kaiser Aluminum, Alcoa, Alcon, Olin-Mathieson, Reynolds. British Aluminium has also been approached.

Discussions between representatives of the Ghana Government, Valco and the World Bank were proceeding last week. Financial details, but reliable sources indicate that one outstanding issue was the price of hydro-electric power to be supplied to the smelter. The price fixed by the Ghana Government apparently, considered particularly active by the aluminium in-

Electrification

A rural electrification survey, reported in last week's **ELECTRICAL**, is to be undertaken by the British Engineering Projects Ltd.

S. AFRICA

Aluminium Plant

An aluminium extrusion plant is to be installed at the Pietermaritzburg works of the Aluminium Co. of South Africa, part of a £2½ million expansion programme.

Surplus Profit

African Railways now expect a surplus of £10 million instead of a deficit of £1.7 million. Confactors to this surprising change in financial position are attributed to

the aluminium transmission conductor 460 kV prototype transmission line at the Kaiser Aluminium factory. The 460 kV transmission line is for development purposes by the Pennsylvania Electric Company. Data on conductor performance under various conditions will be obtained on four of the line each equipped with different diameter conductors. Expanded tests are used with diameters of 1.75 and 2.32 in. An unusual feature of the line is use of an aluminium clad of paper for the 1.75 in. conductor. Measurement of a.c. resistance, conductor temperature and loss as functions of load will determine the most satisfactory conductor for e.h.v. systems

a large increase in export trade, some reductions in wage scales and the electrification programme. South African Railways have 2,000 out of a total of 14,000 miles of track electrified and a further 1,000 miles are under construction or planned.

PAKISTAN

First Shadiwal Set Commissioned

The first hydro generator rated 6.75 MW in the Shadiwal project was commissioned on 9 Nov. The second set is expected to be commissioned before the end of this year. The Shadiwal station is on the Upper Jehlum Canal, seven miles from Gumrat. Estimated cost of the station is Rs38 million. It is being constructed under the Colombo plan.

The Director-General of WAPDA, Mr S. Monawar Ali, recently visited Chicago to discuss the master plan of the West Pakistan Water and Power Resources with the consultants, Messrs Chase I. Main, with particular reference to the Kunhar Valley project.

Bengal Island Generation

The East Pakistan Governor recently said it was planned to install generators on each of the islands in the Bay of Bengal. It was hoped that electrification would assist the development plan, designed to attract people to the islands.

AUSTRALIA

Power Station Tender

Tenders for a 120 MW power station at Collie are expected to be called for by the Electricity Commission of Western Australia shortly. The station will be near the open-cast Muja coal-cut. Construction is estimated to cost £A10 million and is expected to begin in 1962.

Queensland Development

Confirmation that the Merz and McLellan report on development of the Queensland State Electricity System was in circulation was given recently by the chairman of the Capricornia Regional Electricity Board. The report has not been made public and it will be presented to Parliament when the Minister

returns from overseas. The chairman said the Capricornia Regional Board was not yet in a position to give a definite statement on the site likely to be chosen, but they considered the Central Queensland site to be an excellent one.

Western Australian Finances

Estimated expenditure by the Southern Electricity Commission during the current financial year is estimated at £3,378,000 of which £500,000 will be provided from the general loan fund. It is proposed to call for tenders for a new station at Collie and expenditure at Bunbury power station will be £1,186,000. A further £182,000 would be spent on harbour works at Bunbury. The estimates for Western Australia total more than £7 million, of which a large proportion will be devoted to water supplies. The allocations also include £301,000 for an industrial development department to attract new industries to Western Australia.

Rural Electrification

Extension schemes costing more than £1.1 million are proposed in the rural areas adjoining the towns of Narrabri and Armidale. Electrification of the Walgett shire will bring supplies to the towns of Rowena, Collarenebri, Carinda and Pokataroo. The scheme will involve construction of 1,500 miles of power line. The Armidale scheme includes two major extensions, one to Moona Plains, Tia and Yarrowitch and the other from Ebor to Jeogla. These extensions total 160 miles.

NEW ZEALAND

Aluminium Smelter for Southland

An aluminium smelter is to be constructed at Bluff Harbour, Southland, by Australian Consolidated Zinc. The project will bring £A160 million capital to Southland and is reported to provide for a 100 MW power station to be constructed by Consolidated Zinc within the next ten years, and that within 20 years the output must be raised to more than 600 MW. New Zealand is said not to be committed to capital expenditure in the project, but all fixed assets will revert to the State at the termination of the agreement.



Personalities *in the industry*



Mr H. N. Beenham



Mr J. G. Park



Mr A. Warren



Mr E. Green



Mr E. L. Hefferman

Deputy station superintendent at Connah's Quay power station since July, 1956, **Mr H. N. Beenham**, A.M.I.E.E., has been promoted to station superintendent there in succession to **Mr J. Evans**, who has transferred to a similar post at Ince. (*ESH, page 74.) Educated at Gravesend Technical College, Mr Beenham joined the West Kent Electric Supply Co. in 1936 as control engineer and, after subsequent service in various power stations in the London area, became charge engineer at Bromborough in 1951. Three years later he went to the new Connah's Quay station as operation superintendent.

The new purchasing officer of the North Eastern Electricity Board is **Mr J. G. Park**, M.I.E.E., M.AMER.I.E.E. He has been appointed to succeed **Mr Harry Haigh**, M.I.E.E., who has now retired (*ESH, page 149). Since February of this year Mr Park has been the Board's organisation and methods officer, prior to which he was senior operational research engineer with the Eastern Electricity Board. On leaving Manchester University, he commenced his career with the Lancashire Electric Power Company, afterwards serving with the Electricity Board for Northern Ireland and the Metropolitan Electric Supply Co. In 1938 he was appointed assistant superintendent of the Outside Department of the Northmet Power Company and after nationalisation of the industry became construction engineer in the Northmet sub-area of the Eastern Electricity Board. Mr Park has twice been seconded for overseas service; in 1946 as a member of the Hydro-Electric Mission in East Africa, and from 1955 to 1958 as electrical engineering adviser to the Government of Ceylon.

Mr A. M. F. Palmer, A.M.I.E.E., M.INST.F., of the Electrical Power Engineers' Association, is among those

seeking selection as Labour candidate for the parliamentary by-election at Small Heath, Birmingham. He has been nominated by the Co-operative Party. Mr Palmer was MP for Cleveland (Yorks) from 1952 to 1959.

Mr A. Warren has been appointed as head of the Purchasing Dept. and Stores of Gent and Co. Ltd. He started with the company in 1922, has been in the Purchasing Dept. since 1941, and assistant purchasing officer for the past five years.

President-elect of the Chartered Institute of Secretaries for 1961 is **Mr S. M. Rix**, F.C.I.S., H.C.A., deputy chairman of the Southern Electricity Board. He has been vice-president in the current year and takes up duties as president on 1 Jan., succeeding in that position another prominent member of the electricity supply industry—**Mr Ernest Long**, F.C.I.S., F.S.A.A., F.I.M.T.A., who is a member of the Electricity Council and of the CEEGB.

Mr F. Burgess (Whites-Nunan Ltd.) has been re-elected chairman of the British Valve Manufacturers' Association for the year 1960-61. **Mr K. M. Leach** (Audley Engineering Co. Ltd.) has been re-elected vice-chairman. A new member of the committee is **Mr B. S. Bass** (Dewrance and Co. Ltd.).

Plant engineer with Skefco Ball Bearing Co. Ltd., of Luton, for nearly 25 years, **Mr A. I. Helm** has been appointed works manager of the company's proposed new factory at Irvine, Ayrshire.

Mr E. Green, M.Sc., M.I.E.E., formerly head of Transmitter Advanced Development Group at Marconi Wireless Telegraph Co. and, for the past six years, a consultant engineer to the company, has retired after 47 years' distinguished service. Mr Green is an engineer and physicist who for many years has been

a well-known personality in the radio engineering world. He was assistant to C. S. Franklin at the time of the developments of the Marconi-Franklin shortwave beam system and the first seven marks of the Marconi SWB transmitters. Subsequently, he became head of the group responsible for the later marks of this equipment, which included the first 100 kW short-wave transmitter for the BBC. To mark his retirement he was presented with an inscribed gold watch and an oak filing cabinet by Mr B. N. MacLarty, engineer-in-chief, on behalf of his many friends and colleagues.

Mr E. L. Hefferman has been appointed district engineer at Hendon to the Eastern Electricity Board, to succeed **Mr R. H. Farrow** (*ESH, page 110). Educated at Holmwood College, Bexhill-on-Sea, and the City and Guilds (Engineering) College, Mr Hefferman received his early training with the electricity department of the Finchley UDC. In March, 1930, he obtained an engineering appointment with the North Metropolitan Electric Power Supply Co. in their outside department and five years later transferred to the Wembley undertaking as an assistant engineer. Early in 1948, shortly before nationalisation, he was appointed first assistant engineer at Hendon.

The sixth **Earl of Verulam**, formerly Mr John Grimston, has been elected chairman of Enfield Rolling Mills Ltd. following the death of the fifth Earl. **Mr W. R. Brudenell Foster** has been elected vice-chairman.

The Yorkshire Electricity Board have made changes in the district engineering organisation of the No. 4 (Leeds) sub-area. In place of the Leeds district, new districts have been established. The appointment of staff is being effected by stages, and the following initial senior appointments have been made. Leeds North West: district engineer is **Mr A. R.**

* Denotes revision to the "Electricity Supply Handbook, 1960."

M.I.E.E., previously second assistant engineer, construction section, No. 4; Leeds North East: district engineer is **Mr S. T. Richardson**, A.M.I.E.E., previously second engineer, Leeds district (plan- Leeds South: district engineer is **essop**, GRAD.I.E.E., formerly second engineer, operation and maintenance, No. 4 sub-area; and for Morley the district engineer and manager is **Mr F. H. Beal**, A.M.I.E.E., formerly second assistant district engineer, local manager (*ESH, page 145). Changes concern only the engineering activities of the Leeds district; communication and other operations are unchanged.

R. M. Geddes has been appointed part-time member of the UK Energy Authority for the four-year period from 21 Nov., 1960, to Nov., 1964. Mr Geddes joined the Rubber Co. in 1935, and became managing director in 1957. He is a member of the Grand Council of the

Council of the Institute of Physics and the Physical Society have awarded the Duddell Medal to **Dr J. B. Birks**, director-general of CERN (the European Organisation for Nuclear Research) for his leadership of that team.

Mr Hill, who is being transferred from Electrical Industries' fluorescent factory at Enfield to become on supervisor in the new fluorescent plant at Melbourne, sailed for Australia in the P and O liner *Orion* today. The project is planned to start production early in the New

present Norfolk sub-area accounts to the Eastern Electricity Board.

W. Jordan, F.C.A., A.I.M.T.A., has been appointed to succeed **A. Pickup**, A.C.A., when he retires, as district sub-area accountant (*ESH, 09/110). Mr Jordan commenced work in the office of a chartered accountant in Norwich in 1926 and from 1945 held various appointments in local government, including the office of deputy borough treasurer at Norwich. In 1945 he was appointed borough treasurer of the County of Darlington, in which post he remained until 1948 when on nationalisation the electricity supply industry he took his present appointment. Mr Jordan is also treasurer of the Norwich branch of the EIBA.

Royal Society announces that the Instrument Fund Committee have granted of £1,400 per annum for research, in supplement of a previous grant of £1,000, to **Prof G. F. J. Garlick**, department of physics, University of Hull, for continuation of work on solid state image amplifiers; of £2,000, in supplement of a previous grant, to **Prof H. G. J. Jones**, professor of applied electron physics at Imperial College in the City of London, and **Dr D. Jones**,

for additional equipment for use in connection with the development of an electron interference microscope; and of £1,000, in supplement of a previous grant, to **Dr H. B. Barlow**, assistant director of research, department of physiology, University of Cambridge, and **Mr P. E. K. Donaldson**, technical officer, physiological laboratory, University of Cambridge, for further work on the development of (a) a device for automatically improving coding of messages and (b) a diffused storage sequence engine.

Mr E. B. Thompson, sales manager, Ekco Electronics Ltd., has been elected chairman of the Nucleonics Group of the Scientific Instrument Manufacturers' Association.

Mr Harry West, M.Sc., M.I.MECH.E., M.I.E.E., has been elected a director of Associated Electrical Industries as from 1 Jan., 1961. He is managing director of Associated Electrical Industries (Manchester) and a director of other companies associated with the group, including Metropolitan-Vickers-Beyers, Peacock, Sunvic Controls Ltd., Nucleonic Investments Ltd., and chairman of Nuclear Graphite Ltd. Mr West started his career as an apprentice with Metropolitan-Vickers in 1918, where he became chief engineer, Motor and Welding Departments in 1940, assistant to the chief electrical engineer of the company in 1946, chief electrical engineer three years later, and was appointed to the MV board in 1951.

Mr Henry Chisholm, joint managing director of A. C. Cossor Ltd., has resigned. He and **Mr James S. Clark**, who now becomes sole managing director, were appointed joint managing directors in 1947.

Today, 24 Nov., marks the completion of 70 years' service with Falk, Stadelmann and Co. Ltd. by **Mr C. H. Bailey**—truly a remarkable record. Starting as an office boy to the late Mr Victor Falk, he was soon promoted to assist the latter in the buying of gas glassware, and in 1902 the two undertook their first long overseas trip, visiting many glassware factories in order to establish what is now the Electric Glassware Department. When Mr V. Falk was forced to retire from active business in 1912, owing to ill health, Mr Bailey took complete control of "B" Department. He held the latter post until his official retirement in 1951, since when he has continued to assist in intricate import matters.

Mr A. S. D. Barrett has been appointed consultant to Research and Control Instruments Ltd. and has joined the board.

As a consequence of the death of the company's chairman, Sir Cecil Weir, the directors of International Computers and Tabulators Ltd. announce new appointments. Pending the appointment of a new chairman, **Mr H. V. Stammers**, becomes

acting chairman, **Mr C. Mead** is a deputy chairman, and **Mr J. Bull** becomes managing director. Mr Stammers is also chairman of Computer Developments Ltd., the jointly owned subsidiary of the General Electric Co. Ltd.

Mr K. G. Smith has been appointed investment manager of the pension fund of the General Electric Co. Ltd.

OBITUARY

Mr W. McKenzie, M.B.E., of James McKenzie Ltd., electrical contractors, of Birkenhead, died on 13 Nov., aged 53, only a month after the death of his brother, James, who was head of the business.

Mr R. M. Atkinson, M.I.MECH.E., M.I.MAR.E., chairman of Sulzer Bros. (London) Ltd., and a director of Richardson, Westgarth and Co. Ltd., died on 12 Nov., aged 70. He joined Sulzer Bros. in 1938 as managing director and became chairman last June. Earlier he was with the Vickers organisation for 30 years, latterly travelling widely in connection with the group's overseas sales policy.

Mr C. T. Crisp, A.M.I.E.E., who retired 32 years ago as executive engineer of the Post Office North Engineering Section at Brighton, died on 13 Nov., aged 92.

Mr W. J. Taylor, chief electrical engineer to the State Electricity Commission of Victoria for the past ten years, died recently, aged 60. He had served with the Commission for 23 years, and for many years represented it on committees of Australasian and international electrical organisations.

Mr P. M. Bennett, WH.EX., F.R.G.S., M.I.E.E., A.M.I.MECH.E., who was a consulting engineer with Whitehall Securities Ltd. until retiring in 1944, died on 15 Nov., aged 84. He was assistant works manager of C. A. Parsons and Co. from 1898 to 1901, when he joined the Callender's Cable Co. as construction engineer and, subsequently, spent 12 years in Mexico on Government and various utility contracts. There followed periods with the Mexican Eagle Oil Co. and, from 1917 to 1919, with the Ministry of Munitions, and he was later associated with electricity schemes in Chile and the early part of the grid scheme in this country. Subsequently, with Whitehall Securities, he was concerned with the Athens undertaking for a number of years.

Mr P. L. Edwards, manager of the Dublin office of Associated Electrical Industries until his recent retirement, died on 14 Nov.

Mr T. P. W. Norris, deputy chairman of George Kent Ltd., died in hospital at St. Albans on 21 Nov. from injuries received in a motoring accident. He was 68. He joined the company two years ago, prior to which he was chief personnel officer of the Vickers group for 13 years.

Protective gear saves on distribution c.b.'s

by G. Hall,* A.M.I.E.E.

CONVENTIONAL design of distribution systems requires the provision of an e.h.t. o.c.b. for each transformer, even though it is exceptional for the latter to exceed a rating of 750 kVA. If this practice is accepted, then it must also be accepted that each substation is large enough to accommodate e.h.t. switchgear, transformer and medium voltage fusegear.

Elimination of the transformer e.h.t. o.c.b. from the design of a distribution substation would obviously effect considerable economy in both capital costs and size of substation.

Control and Protection Requirements

The basic requirements for the control of a group of distribution substations are:

- (1) A fault on any item of equipment must be automatically cleared with the minimum disturbance to the rest of the system.
- (2) A means of isolation for all items of equipment is desirable.

(3) The effect of a fault on the magnitude of load lost as a result of that fault should bear some relation to the type of load.

The fault levels encountered in a typical distribution network range from 50 MVA to 250 MVA for the e.h.t. system, and with modern transformers from 5 MVA to 15 MVA for the medium voltage equipment within substations. Resistance earthing of the e.h.t. system neutral restricts earth faults to a relatively low value equivalent to 30 MVA to 60 MVA three-phase fault levels.

The protection requirements are, therefore:

(1) High voltage faults in the range 30 MVA to 250 MVA must be detected and cleared as quickly as possible.

(2) Medium voltage faults in the range 5 MVA to 15 MVA must be detected and cleared with a suitable delay to allow m.v. fusegear to operate if the fault is on the m.v. network.

Conventional design satisfies these control and protection requirements by the use of i.d.m.t. relays on e.h.t. feeder o.c.b.'s and time fuse protection on individual transformer o.c.b.'s. Fig. 1 shows a typical arrangement.

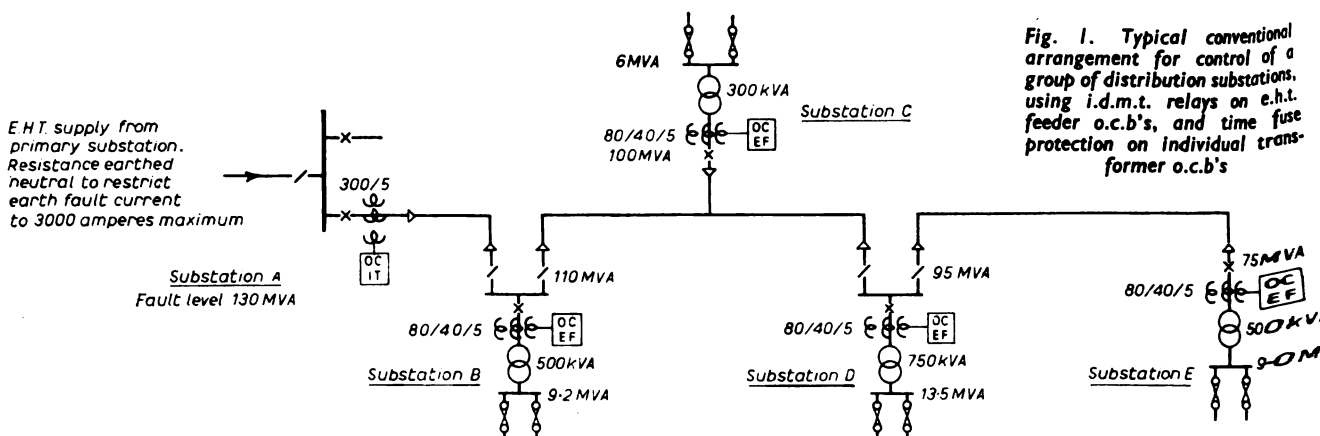


Fig. 1. Typical conventional arrangement for control of a group of distribution substations, using i.d.m.t. relays on e.h.t. feeder o.c.b.'s, and time fuse protection on individual transformer o.c.b.'s

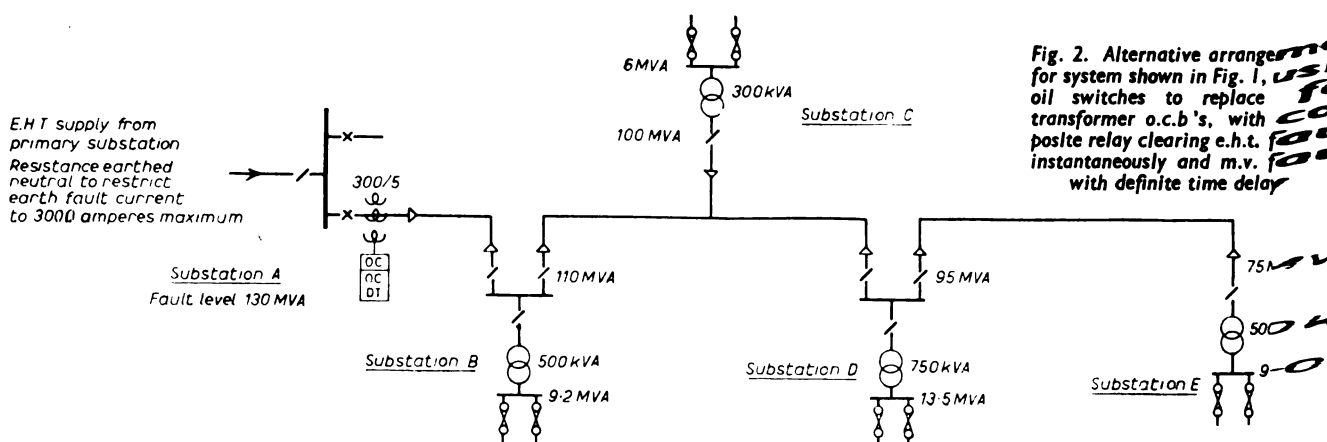


Fig. 2. Alternative arrangement for system shown in Fig. 1, using oil switches to replace transformer o.c.b.'s, with positive relay clearing e.h.t. faults instantaneously and m.v. faults with definite time delay

* Mr Hall is with the Leeds Sub-Area, Yorkshire EB.

re System

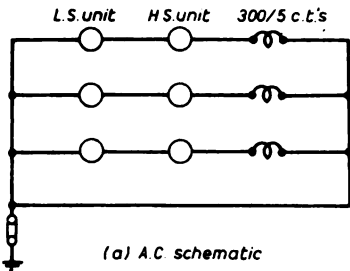
irements for control and protection can be an alternative design which effects a consider- ny in switchgear. This system requires accept- o conditions on which opinions may differ. ult incidence on distribution transformers is r than for the more vulnerable high voltage d, where mainly domestic consumers are con- fault on a distribution transformer can be interrupt supplies to consumers from other bstations.

ows the alternative method applied to the net- i in Fig. 1. Four transformer o.c.b's have been four oil switches, two of which would be of mer flange-mounted type. At the substation the e.h.t. feeder the i.d.m.t. relay has been a composite relay to give instantaneous clear- e.h.t. faults and definite time clearance on all at the distribution substations. A transformer y of the four substations or an e.h.t. feeder , therefore, result in loss of supply to all four

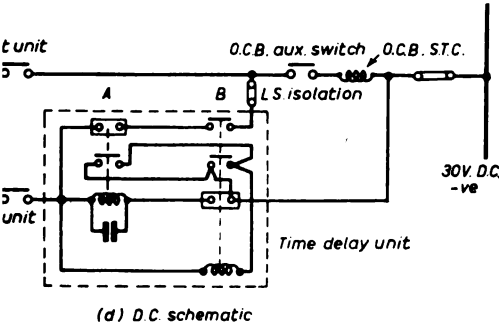
ism can be compared with the group protection unted transformers on overhead distribution

e Relay

installed at Substation "A" in Fig. 2 has been o satisfy the requirements of the alternative . 3 shows the connections for this relay y. Fig. 4 shows the actual relay. The left-hand ects faults on the e.h.t. system, but is given a ng in excess of the maximum m.v. fault level e substations. Operation of this unit produces is tripping of the o.c.b. For detection of m.v. centre unit is given a setting lower than the fault level, but in order to discriminate with egear a definite time delay is provided. od adopted to obtain this time delay can be : schematic diagram of connections, Fig. 3. ed armature relays are employed, A and B, nted by a capacitor. The sequence of operation w-set element contacts close is as follows:



(a) A.C. schematic



(d) D.C. schematic

schematic diagram of connection of composite relay

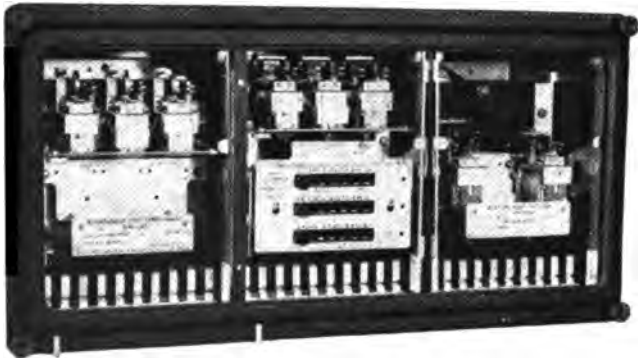


Fig. 4. Arrangement of composite relay (English Electric Co.)

- (1) Relay A picks up via the normally closed contact of relay B.
- (2) Relay B picks up via the normally open contact of relay A, and in so doing seals itself in and breaks the circuit for relay A.
- (3) Relay A resets slowly due to the capacitor and completes the trip circuit via its own normally closed contact and the normally open contact on relay B.

This arrangement gives an overall time delay of 0.4 sec, a time which experience has shown will give discrimination with m.v. fusegear. Standard components are used throughout the design of the relay to avoid high production costs.

Practical Example

The network shown in Figs. 1 and 2 produces fault levels as indicated, and the protection is required to operate on these values. The e.h.t. voltage has not been stated as it is desired to demonstrate the method for both 11 kV and 6.6 kV systems. The fault levels used are typical for systems operating at either voltage.

The instantaneous high-set element is required to operate down to fault currents of 2,500 A, but must not operate for an m.v. fault level of 14.4 MVA. At 11 kV, this level produces phase currents of 750 A, and at 6.6 kV, 1,324 A. With 300/5 current transformers a setting of 400% at 11 kV (1,200 A) and 600% at 6.6 kV (1,800 A) would be adopted. This gives a margin of safety for both maximum m.v. fault level and minimum e.h.t. fault level at either system voltage.

The range of fault levels on the m.v. busbars at the four substations is wide, but only the lowest is considered in determining the setting for the low-set unit. This occurs at substation C with 5 MVA, giving 260 A at 11 kV and 438 A at 6.6 kV.

The required settings would, therefore, be 50% at 11 kV (150 A) and 100% at 6.6 kV (300 A). A margin of safety is given in both cases; in fact, at 6.6 kV a 75% setting would be adopted provided this did not encroach upon the full load current of the particular network.

Load Limitations

The question of maximum loading conditions occasions the immediate criticism of this system of protection, but if the number of substations in the group protected is not excessive, this problem should not arise. In the example given, the maximum load at 11 kV must not approach 3 MVA and at 6.6 kV, 2.5 MVA (75% setting). The installed transformer capacity is, however, only 2,050 kVA.

Future load increase must be considered, but it would normally be the smaller transformers that would require changing for larger, with a consequent increase in minimum m.v. fault level. A higher setting would then be

possible for the low-set element, with consequent increase in maximum loading.

In certain cases an alternative e.h.t. supply is available to a feeder from another primary substation or from another feeder from the same source. In such cases the alternative system can still be adopted, but when making parallels the low-set element should be made inoperative in order to avoid tripping due to heavy transfer currents. For this purpose an isolation link is provided in the low-set trip circuit.

Operating Experience

A number of installations of the composite relay as described have been employed over a period of two years. During this time no trouble has been encountered which was not anticipated; the only failing has been the operation of the low-set flag indicator when re-energising the network after complete shutdown. This was anticipated, however, and is, of course, due to the magnetising current inrush of the distribution transformers.

NUCLEAR POWER PROSPECTS

OPTIMISM on the prospects for nuclear power was shown by four leading authorities in the field who a short while ago discussed the question at a meeting of the International Atomic Energy Agency. They were Dr H. G. de Carvalho (Consultant to the Brazilian Atomic Energy Commission); Dr J. V. Dunworth (Deputy Director, Winfrith, UKAEA); Dr J. Horowitz (Head of Reactor Department at the French Saclay Nuclear Research Centre) and Dr W. H. Zinn (formerly Director of the US Argonne National Laboratory).

The first question to be considered was the current technical status of nuclear energy. Dr Dunworth suggested that a comparatively small number of reactor systems were emerging within the range of being acceptable economically. They fell into two broad classes, the gas-cooled, graphite-moderated reactor systems being developed in Britain and France and more recently in the US; and the pressurised and boiling water systems receiving attention in the USA, Russia, Canada and, on a smaller scale, in Scandinavia.

On the same topic, Dr Zinn said that a large pressurised water reactor had about 40 miles of tubular fuel elements in it. Failure rate in these was an important factor which only full-scale operating experience could determine. He believed that in the UK, France and the USA, the next two or three years would bring answers to many questions such as this, having a major effect on cost of nuclear power generation. On the question of safety, he said that the extensive experience with pilot plants had brought to light no unfavourable facts. He regarded it as essential from a safety aspect that the design, operation and siting of nuclear plants should come under the scrutiny of an official or agency independent of the supplier of the plant and its user.

Costs of Generation

On the vexed question of cost of generation, Dr Dunworth estimated that nuclear power stations currently being ordered in the UK would generate at costs not more than 10% above those for new conventionally fuelled power stations. A 15% rise in oil or coal prices in real terms would be sufficient to offset the difference. He suggested that experience gained through building nuclear power stations would be ample return for the extra cost that had to be paid. However, for small- and medium-sized reactors the high capital cost made economic operation somewhat uncertain, except in the most remote places.

From the American standpoint, Dr Zinn thought that the first competitive nuclear power station in America might come in 1967 in a high fuel cost area of the country. The best foreseeable designs for 50 MW nuclear power stations missed being competitive by about 20%. Dr Horowitz thought stations to be built in three or four years' time in France, with capacities of about 500 MW electric from one

reactor, would certainly be competitive if fuel burn-up of between 3,000 and 3,500 MWd proved possible.

The question of burn-up was one of the most important in determining the future outlook for cost reductions, all speakers pointed out. Dr Zinn spoke hopefully of the properties of uranium dioxide in this respect. It was thought that the burn-up limit for this material lay in the neighbourhood of 40,000 MWd/ton to 50,000 MWd/ton. Along with Dr Horowitz, he emphasised that the immediate problem was to get economic nuclear power and until this could be done the idea of "breeding" (getting more nuclear fuel out of the reactor than was put in) had little importance.

Dr Dunworth thought there was need to make the maximum use of containment vessels for nuclear equipment in order to ease siting problems, especially in densely populated countries. He went on to say it would be two or three years before any new opinion could be formed about fast (unmoderated) reactors, at least from the aspect of UK and USA programmes.

Gas Turbine for Lynton

AS part of the SWEB plan for improving electrical supplies to Lynton and Lynmouth, a remote line-controlled 3 MW power station, comprising a 3 MW, 11 kV, English Electric alternator coupled to a 4,250 h.p. Bristol-Siddeley "Proteus" gas turbine, was inaugurated by Sir George Hayter Hames, chairman of Devon County Council on Tuesday last, 22 November. The second of this type of station to be installed by the SWEB, it is remote controlled by dialled signals over the GPO line from the SWEB Control Centre at Bristol, 100 miles away.

Mr A. N. Irens, chairman of the SWEB, welcoming the guests, explained that this was part of a £140,000 scheme to improve the electricity service in North Devon, and the new station had already released the 11 kV overhead line to Barnstaple for conversion to 33 kV and would obviate the necessity of erecting a second overhead line for 10 to 12 years.

A new 33 kV substation had also been installed at Lynton. Experience with the first station at Princetown had shown that these units were an economic way of expanding electrical supply in remote areas, the stations, about the size of a small house, only requiring about four routine visits a year and an overhaul of the sets every ten years. Each station is capable of supplying a town of 10,000 people under emergency conditions and the capital cost is comparatively low. Full protection against fault conditions is provided, the station calling the control centre through Datafonic equipment developed by Sound Diffusion (Auto Thermatic) Ltd.

Radio in the supply industry

D growth in the popularity of radio communications in the supply industry and the form future developments were likely to take was the subject of a presentation to the IEE last week.*

It had been a requirement had been to establish mobile two-way services for communication between control and the field engineers. Recently, the need had taken shape for fixed-to-fixed radio links for those areas where line circuits were not available or could not be economically installed.

When m.f. and h.f. equipment characteristics were known they had proved unsuitable for the supply industry requirements. War-time experience with v.h.f. equipment had, however, led to development of equipment well suited to mobile radio operation.

At the same time, u.h.f. and microwave techniques were not yet advanced for use, but recent development might lead to h.f. links to be applied where their restricted range was not a disadvantage. In other countries there had been strong progress in the application of microwave links to protective gear operation and automatic detection of transient faults, but it was only recently that experimental links had been established here.

Schemes

Systems suitable for the power supply industry required a high degree of reliability and to be capable of 24-hour operation. The best possible coverage was essential, with every effort made to avoid blind spots. Reliability was required rather than of the ordinary commercial mobile radio services. It was not practicable for the supply industry to share radio channels with other services, and in an emergency, the service had to be immediately available, possibly for a prolonged period.

Once had shown traffic density, that is, the minutes of occupancy over a given period, could be as high as 100% for a 24-hour period or 90% for a 36-hour period, during peak system outages. Even on the consumer side, traffic saturation was often as high as 65%.

Generally, amplitude modulated equipment showed a decrease in signal strength over frequency modulated. Installations using frequency modulated equipment exhibited a gradual decrease in signal as the limit of their range was neared, whereas amplitude modulated tended to cut off sharply. The advantage of frequency modulated in restricting impulsive noise pick-up had also, to some extent, been counteracted by recent a.m. developments. M.F. equipment also tended to be more complex than schemes had proved easier to maintain.

In a single-frequency complex system, all equipments were normally set to receive, and each unit could hear all others could also intercommunicate without the fixed station being operative. However, it was impossible with a single frequency to transmit and receive messages simultaneously. This had certain advantages for it reduced power

consumption and also prevented "butting in" when a message was being received.

An alternative form of the single-frequency-complex system used two frequencies. With this scheme all mobile stations were able to transmit on one frequency and receive on the other, ensuring that all messages had to be handled through the fixed headquarters station. The two-frequency system, although at first sight uneconomical in use of available frequencies, was more readily adapted to prevent interference between different users with adjacent frequency bands. The GPO allocated frequencies on the two-frequency basis to avoid such interference problems.

If it was necessary for mobile stations to intercommunicate, a talk through switching circuit could be used at the fixed station to enable the frequency of incoming signals from one mobile to be changed to the reception frequency for another mobile. However, there was a difficulty with this system, for it was possible for transmissions from other areas to trigger the local transmitter and then reradiate them. This could give rise to numerous spurious signals.

The fixed single station could give adequate coverage within a radius of, say, 20 miles, but for larger areas several transmitting stations were often required. Such stations, operating on what was termed the "multi-carrier system," were standard except that their transmitters were tuned to frequencies of 8 kc/s or 10 kc/s apart, with 100 kc/s spacing. Recently, it had been possible to arrange multi-carrier schemes for only 25 kc/s channel spacing and with an offset of 4½ kc/s.

The high standard of performance required from supply industry radio equipments suggested that construction in accordance with service specifications was desirable, particularly on vital circuits such as those for protective gear operation. It was hoped by applying DEF 5,000 and similar standards, better reliability coupled with ease of maintenance would be possible. The supply industry had themselves prepared draft specifications and these were now under discussion.

Remote location of fixed station transmitters often called for emergency standby power supply. Possible future developments in this application were the long-life dry cell or the solar cell.

Fixed Radio Links

For the protection schemes required with the grid there were in general, sufficiently adequate telephone facilities available. However, the national telephone system could not economically or physically provide the immense number of lines which would be required for the substation and load points in a distribution network. Industry had only limited permission to operate fixed-to-fixed radio systems, but there was a considerable programme of experimental work devoted to investigating radio links for telephony, telemetering and protection. The authors, however, maintained that they should only be used where some definite advantage in cost or in overcoming a limitation

3290: "Radio Communication in the Power Industry," Cox, M.I.E.E., and R. E. Martin, D.F.H., M.I.E.E.

made them essential. A possible application was that analogous to power line carrier protection between two substations.

Frequencies Available

The frequency allocations by the Post Office originally based on a station spacing of 15 miles have been shown to be completely inadequate. Station separations of 80 miles was necessary to ensure interference-free operation. Investigations have shown that the fuel and power industries require 26 channels, of which 14 were required by the supply industry, and the authors emphasised that industry's needs were sufficiently pressing to warrant a special section

of the frequency band being available for their exclusive use.

The electrical industry had currently a programme tending over three years to convert all existing stations to 25 kc/s channelling.

Future Developments

Other countries were developing v.h.f. fixed/n schemes for selective calling of outlying unattended stations and it seemed probable that there was considerable scope for similar schemes in this country. Data handling techniques in guided missile work could also have application in the supply field.

DISCUSSION

The discussion was opened by MR G. F. PEARSON (deputy chairman, MEB) who complimented the authors on their paper. Post Office restrictions implied a need to conserve radio channels and, as a consequence, the electricity boards had recommended installation of only 25 kc/s channel spacing equipment, even though 150 kc/s was permitted. Insistence of the boards on using this spacing had been justified by subsequent experience. Value of radio as a consumer service was well illustrated by the case of a lady phoning the local office from a call box after her cooker had broken down. She was surprised to find the service van, called by radio, already at her door when she returned.

In the Midlands area, lightning storms travelled up the Severn Estuary through Gloucestershire, Worcestershire and Shropshire. On one occasion recently, in the Worcester area alone, 157 line failures occurred in three hours one evening. Similar numbers of failures in the other areas also occurred and, clearly, more than one radio system was necessary. He considered f.m. transmission between fixed points had many advantages. A phase comparison radio protection scheme had been installed in 1956 for a 14-mile long 33 kV line.

Operation had been stable both for in-zone and out-of-zone faults as a pilot scheme. The scheme had been in full operation since September, 1959, and subsequently six correct faults had been indicated with no incorrect faults.

T. T. BELL (GEC) said there was a very wide discrepancy between the importance of the service rendered and unbearably tight price limits imposed. There could easily be a 2:1 increase in price for the reliability requirements of power systems radio equipment compared with ordinary radios. He thought that for standby power supplies the transistorised converter was better than the rotary generator, especially for digital data equipment, since it had no running-up time. Development work on 12½ kc/s channelling was in hand.

MR J. BRINKLEY (Pye Telecommunications) asked for more information on experience with drift and interference on 25 kc/s systems. He thought there was some misconception about reliability of

radio equipment. Compliance with service specifications was not of itself sufficient guarantee of reliability. Although manufacturers used the best components available, very often they were limited in choice and he thought the onus fell rather more on the component manufacturer than on the equipment manufacturer. Experience had shown that although there was wide variation in faults, there was remarkable agreement between different manufacturers' equipment. An average figure was four faults per mobile transmitter per year. Of these faults 30% were due to valve failure, 10% to vibrators, when they were used, and the remainder to miscellaneous components. Progress in fixed-to-fixed equipment had not been particularly good in this country and it was depressing to compare our installations with those in the US and Japan. This was particularly true of telemetering systems, for which we lacked sufficient pilot schemes.

MR J. PEARSON (Elliott Bros.) said in view of the frequency shortage, possibly more attention should be devoted to u.h.f. equipment. His experience over the last three years had shown that the range was less than v.h.f. with deeper fading and it had good possibilities for local schemes.

In reply, Mr Cox agreed that it seemed strange that industrial users had to struggle to use 12½ kc/s equipment, which was new and untried, while aircraft still had room to manoeuvre with 100 kc/s. Referring to the controversy between f.m. and a.m. equipment, he said that a.m. was easier to maintain, more robust and gave better coverage. F.M. was more appropriate for fixed links. Referring to standby power supplies he said an inverter was required having an efficiency of at least 80% at 50 c/s and with good wave form. Existing rotary converters were only about 50% efficient. He agreed with Mr Brinkley on the need for pilot telemetering schemes. The point about service specifications was that they ensured good equipment at an economic price. Variations were due to lack of quality control rather than non-compliance with specifications.

Criticism of radio links when compared with GPO lines was levelled by

MR S. W. DILLOW (CEGB). Stations, he said, were normally in valleys, and that implied use of stations on adjacent high ground consequent reduction in reliability saw no significant advantage in u.h.f. equipment since outage time on GPO lines averaged only 15 hr/y

In reply, Mr Martin pointed out that in the US power stations were sited yet u.h.f. links were extensively used. Practice was to send the signal by cable to a transmitter on a hill. Users of radio links in this country considered 1 hr/year a reasonable outage time, which compared favourably with the GPO figure quoted.

Commenting on experience with NSHEB, MR A. J. DAVIDSON said adverse weather conditions had been cases of charged clouds coming down systems on reverse transmission. Referring to reducing channel spacing to 12.5 kc/s, he thought difficulties may arise with voice transmission. He asked if the authors had any indication of GPO policy on all of microwave bands, for example the 7,000 Mc/s range. Such frequency may be better for low density since they could avoid use of relay stations. Mr Martin said permission had been obtained to install a 7,300 Mc/s wave link and it was hoped this would be in use in Essex early next year.

In reply to other points raised by Mr Anderson, Mr Cox said that for service schemes were based on the principle that operational traffic would be given preference over commercial users. Operational traffic was peaky, but commercial traffic remained fairly uniform. Referring to three-station schemes, Mr Dallow said the CEGB had one in commission but had experienced no problem with frequency drift. Such schemes required careful setting, maintenance was difficult and more instrumentation was essential. He had no doubt that for power systems were preferable for control.

Concluding the discussion, MR BUCKINGHAM (Chief Engineer, MEB) in spite of comments by some speakers experience had shown that supply continuity was vastly improved by radio links.

PROBLEMS AND PRACTICE

In the Dark

As a service engineer, I was once sent to a film laboratory to check the setting of a voltage regulator on a generator set. There were two sets supplying 110 V d.c. busbars which supply ran to printing machines. As was usual in this environment, printing took place in a dark room with only the very smallest red neon lamps. Each machine required a current for running the motor and the printing lamp, a 50 V bulb with a dropping resistance. Two motor generators were driven by Isenthal MS type voltage regulators driven from the shaft of the printing lines being coupled to the machines through fuses and the field busbars through a single-pole switch in the positive line. At one set was running and the other was shut down for maintenance, the relevant switches being open and the line fuses removed.

While doing maintenance work on the dead set, I removed the cover and disconnected one of the vibrators. In doing so, the screwdriver inadvertently bridged between the vibrator and the metal case. There was a flash and a small burn appeared on my face. This seemed strange on a machine and I felt no shock touched the contact with my screwdriver. Repeating the experiment, again a flash, so I called the maintenance man.

We applied a voltmeter to the dead set and the instrument showed 50 V. I left it to him to locate the fault and called back a few days later. This time he had, with difficulty, located and removed the trouble. It so happened that neither of the d.c. busbars was earthed but on one of the machines an earth fault had occurred between the dropper resistance lamp. As the diagram shows, this provided a feedback path to the busbar to be created via the negative line on the "dead"

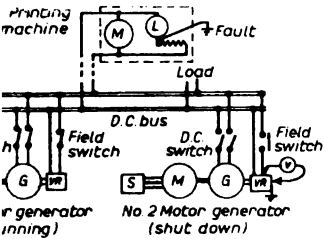


Diagram of a printing lamp circuit on an unearthed d.c. busbar. The fault is disclosed as a "live" feed on a "dead" motor generator.

generator, the lamp and resistance acting as a potentiometer.

Now, locating a fault in pitch darkness calls for some patience and luck and I asked him how he had traced it. For those with a liking for detective stories the answer is interesting. He had received a complaint from the developing room—it was cinema positives that were being processed—that on two prints four of five "frames" were heavily overdeveloped. Back-checking on the printing machine from which they came it seemed obvious that the dropper resistance in the lamp circuit had been "shorted." It had—by my screwdriver. Earthing of the negative busbar, which they eventually did, would have located the fault earlier.—*Ion.*

E.H.T. Control Circuit

IN reply to Mr Thompson (8 Sept., page 616), the functions of the resistance in the secondary of a testing equipment and that of a circuit-breaker are different. The resistance must always be installed to limit the fault current unless the impedance of the secondary circuit is already high. The circuit-breaker is there to interrupt the circuit and give instantaneous indication of breakdown. It is more usual, however, to put the breaker coil in the primary circuit where the current is higher.—*C. Jenkins.*

Those Conduit Plugs

RECENT correspondence on the plugging of conduit ends reminds me of an exasperating experience a few weeks after the Coronation in 1953. We had a job of putting heavier mains into a distribution board from a switch-room about 200 ft away and decided to do the job in 1½ in. conduit. The run comprised a number of elbows and sets, since the route passed through other departments. With the conduit, newly purchased for the job, in position we started to feed a pair of 19/064 v.i.r. cables into the tube when, to our astonishment, we came up against an obstruction half-way along. The surprise was occasioned by the fact that the nose of the cable was in a straight section of the run and was evidently up against something solid. There was no alternative but to cut out the length of conduit for examination and, having done so, we discovered a wooden bung wedged hard in the centre of the tube. Phoning the supplier who had provided the conduit we expressed ourselves forcibly. He apologised and, after a bit of thought, came to the conclusion that the conduit

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

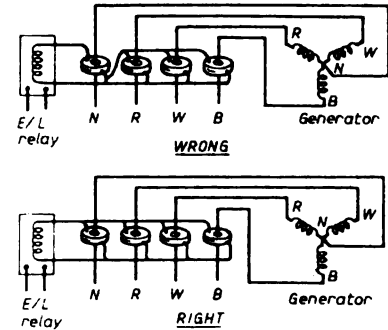
was part of a quantity he had loaned to an organisation for the construction of a car tableau during the Coronation celebrations. His theory was that they had put in some wooden bungs for fixing and had forgotten to remove them before returning to store.—*F. R. Ralph.*

Phantom Earth Leakage

TRouble was being experienced on a medium voltage three-phase four-wire distribution board fitted with a residual type earth leakage relay. During the check period, with the lines carrying out their normal load but the tripping circuit disconnected, the relay was found to have operated several times apparently on the flow of an earth leakage current.

Since the current transformer ratios were 1,200/5 and the relay was set to operate at 10%, it seemed strange that an apparently heavy earth current could persist without other adverse indication. Check tests for an earth fault gave negligible indication though the out-of-balance current in the neutral was in excess of 120 amp.

Primary injection tests were then carried out on the system. They showed that earth leakage current, however great, in the R, Y or B conductors would not cause the relay to operate, but a current of 120 A in the neutral would. Terminal connections between the transformers and relay were then checked against the maker's drawing and found to be as specified, but a further check of the physical connections disclosed that the R, Y and B transformers were not connected across the relay, only the neutral. A slight adjustment to ensure that all four secondaries were in parallel across the relay cured the trouble, showing once again that not all manufacturer's drawings can be relied upon without question.—*E. A. Robbins.*



Transposition of one connection to the neutral produces a phantom earth leakage condition.

for the electrical trade

Spin-dryer price cuts

CONSIDERABLE price reductions are announced for the two Easiclone spin dryers. Model SD 1, originally priced £31 13s tax paid, now sells at £24 3s, whilst SD 2 is reduced from £24 3s to £21. Prices are effective immediately. *Easiclone Porcelain Enamel (1938) Ltd., Lord St, Chapel Ash, Wolverhampton.*

New 'fridges from Frigidaire

IN their new "Sheerlook" refrigerator range, Frigidaire appear to have aimed not at "breakaway" styling but at utilisation of the best in current trends. Their cabinets are straight-edged with a minimum of decoration, and vitreous enamel flat tops provide the working surface which is so often an optional extra in other makes. Doors, however, curve outwards slightly at the edges—this diversion from the basic style enhancing the slimness of the cabinets. In contrast to this economy of line a range of unusual colours is available: green, red, cream, pink and the normal white. Interiors are also coloured in a number of shades and a novel detail is the tracery on the blue freezing and dairy compartments. Door catches are completely abandoned in this range: magnetic gaskets provide effortless closing and opening. All three cabinets feature interior lighting.

The smallest, a 2.9 cu ft model, the smallest refrigerator Frigidaire have ever produced, has three shelves and a transparent crisper tray. Its freezer will store 5 lb of frozen food. There is no dairy compartment in this model. The 3.8 cu ft version has a much wider freez-



TRADE PUBLICATIONS

G.E.C.—Three technical leaflets on furnaces: Induction heating furnaces (E.67); High temperature furnaces with hydrogen atmosphere, 1,200°C-2,500°C (E.78); and Roller hearth furnaces (E.75). General Electric Co., Erith, Kent.

NEGRETTI.—11-page illustrated brochure on Contract Engineering facilities. Publication No. C.100. Negretti and Zambra, 122 Regent St, W.1.

PARCOLINE No. 15.—Sales information Bulletin No. 4 on a conditioning rinse for use after "Pyluminizing" metal finishing process. The Pyrene Co., Metal Finishing Division, Gt. West Rd, Brentford, Middx.

PLESSEY.—52-page illustrated brochure on range of UK-AN connectors—design, contact arrangements, wiring, etc., and accessory equipment. The Plessey Co., Ilford, Essex.

ing compartment and it includes the full-width dairy compartment. Its porcelain top can be removed if the cabinet is to be built-in. The largest model, of 5.1 cu ft, has a full-width freezer. Working on the assumption that it is floor space rather than wall area that is at a premium in modern kitchens, the designers have made it tall and slim.

Prices of the new range are:

2.9 cu ft	MB-30	£51 9s
3.8 cu ft	MB-40T	£61 19s
5.1 cu ft	DB-50	£72 9s

These prices include purchase tax.

Dimensions: MB-30, 33½ in. by 19 in. by 19 in.; MB-40T, 35½ in. by 20½ in. by 21 in.; DB-50, 45 in. by 20½ in. by 21 in. The compressors are guaranteed for five years. *Frigidaire Division of General Motors, Stag La, N.W.9.*

International shaver socket

FOR electric shaver users a special socket-outlet is being introduced which provides connection for all types of plug. There are two models, one for

The commercial version of a socket which takes most types of shaver plug. Domestic model has single-vol age on/off control



5.1 cu ft "Sheerlook," largest of Frigidaire's new range. £72 9s

The "Parnall" washer - wringer sells at £63 with heater

home installation, the other for commercial premises. They incorporate a multi-pin single outlet which can accommodate most shaver plugs of British, American and continental origin. The commercial unit provides 230 V or 115 V supply, using a simple switch selector. This switch gives normal on/off control in the domestic model.

Switch and socket are built into an attractive grey plastics panel 5½ in. high by 3½ in. wide and about ½ in. deep.

The units incorporate 20 W double-wound transformers which have separate primary and secondary windings. Self-resetting thermal trip in the transformer input protects against overheating caused by misuse of the outlet. The single voltage domestic unit is priced £3 19s 6d and the dual voltage model £4 12s 6d. *Chilton Electric Products, Hungerford, Berkshire.*

Fridge price drop

RETAIL price of "Astral" built-in 1.6 cu ft refrigerator is reduced by £3. This absorption type refrigerator, which was described on this page in 18 Aug. issue this year, now sells at £32 10s tax paid. *Morphy-Richards (Astral), 50 Conduit St, W.1.*

Washer with power wringer

A NEW washing machine with power wringer selling at a comparatively low price is the latest appliance under the "Parnall" label. It will be supplied in a non-heated version or with a 3 kW heater. Operating on the agitator principle, the machine is controlled by three switches set in a panel on the front face, one controlling the heater, if any, a centre switch the agitator and a third an automatic emptying pump. The wringer has its own control. Standing only 33.7 in. high, the cabinet can be pushed under the table or draining board when not in use. The wringer is stored in a special compartment. The inner 6½ lb capacity tub has a two-coat finish of vitreous enamel. Prices are: EW52, £56 14s tax paid and EW52H (heated model), £63 tax paid. Table top, as an optional extra, sells at £2 15s tax paid. *Electrical Division of Radiation Ltd., 143 Sloane St, S.W.1.*



equipment for industry

core radio cables

A wide range of multi-core cables suitable for interconnection of radio equipment is announced. These have up to ten p.v.c.-insulated copper cores, screened or unshielded, with current ratings of 1 A. Voltage ratings are 250 V r.m.s. for frequencies to 100 kHz, working temperatures being between -40°C and 85°C. Designated cables, there are two constructions. The first has laid-up cores half-covered with polyethylene terephthalate with a covering of nylon braid, acquired overall; the second has, instead of nylon braid, a tinned-copper followed by a second layer of polyethylene terephthalate tape, the whole being finally covered with lacquered nylon braid. *Rist's Wires and Ltd., Lower Milehouse La, New Staffs.*

earth-borer

A new type of truck-mounted earth-boring equipment is the manually operated turntable having a 180° which enables accurate placing of augers with minimum amount of movement. Hydraulically operated augers are readily available as an option. Range of standard auger bits for normal soil cover bore diameters from 1 in. to 36 in. Powered by a 50 h.p. diesel or petrol, typical boring rates in loamy soil and 2.5 ft/min in ground using a special bit. If required, a hoist can be fitted making up a complete mobile rig for pole boring and drilling. *Cheshire Engineering Co., O. Box 3, Yorktown Wks, Cam-Surrey.*



Cheshire earth-boring rig mounted on Thames Trader truck showing manually-operated turntable

New insulating varnishes

A VARIETY of insulating varnishes and enamels of American origin are now being manufactured and distributed in this country. These include polyester, silicone, phenolic and alkyd based compositions. Examples are: polyvinyl formal enamel for temperatures up to 130°C, suitable for hermetically sealed compressor and air-conditioning plant motors; "isonel" polyester enamel for high temperature working up to 150°C enabling a 25% increase in power output over equivalent Class A insulated equipment; polyurethane enamel for coating fine winding wires used for electronic component has the advantage that it is possible to solder the coated wire at temperatures in the region of 360°C. *Schenectady-Midland Ltd., Oldbury, Birmingham.*

Silicone rubber price cut

FOLLOWING reductions in prices of 15 other grades of silicone rubber, Midland Silicones Ltd. have announced that the cost of their DP2403 self-adhering grade has been brought down from 36s to 31s per lb. This rubber has particular application in the manufacture of insulating tapes, having high thermal conductivity, good heat endurance and resistance to the effects of corona discharge. *Midland Silicones Ltd., 68 Knightsbridge, S.W.1.*

Power transistor cooler

TWO models are available of an aluminium-finned heat-sink for cooling power transistors by natural air convection. One has 16 fins, restricting equilibrium temperature rise to 1½°C/W, the other, having eight fins, allows 2½°C/W, in still air. From results of extensive tests the units are said to give

Marston heat-sink unit for cooling power transistors. This model has an equilibrium temperature of 2½°C/W



Fully tropicalised pulse-operated. Available with either three changeover or five make or break contacts

effective performance under a variety of conditions. *Marston Excelsior Ltd., Fordhouses, Wolverhampton.*

Portable oil filters

A NEW portable "Stream-Line" filter for purification of insulating oil, the P8, incorporates its own pump and motor and will treat dirty oil at rates between 50 gall and 100 gall/hr at 55°F to 60°F. Easily transported and operable by one man, the filter packs can be dried without removal from the filter if a CN plant is available, the P8 being coupled to the larger unit by flexible hoses in a similar manner to a transformer. The electrical load, for the motor, is only 200 W. *Stream-Line Filters Ltd., Henley Pk, Guildford.*

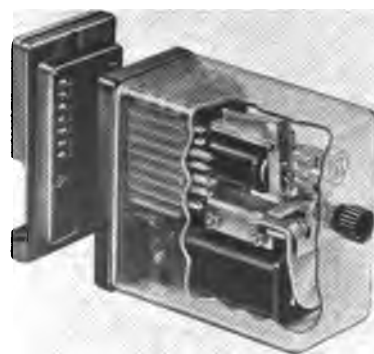
Silicon diodes reduced

SILICON diodes are now selling at prices in the region of their germanium equivalents. Thus a 150 V, 100 mA diode in the "H" range available costs 8s. Others in the range, for which operating temperatures are between -85°C and 200°C, are priced as low as 3s 7d. Compared with germanium types, silicon diodes have higher voltage ratings and operating temperatures, low leakage currents and are claimed to be more reliable. Lower prices, brought about by mass-production techniques, should widen the scope of silicon diodes in applications where previously they were considered too expensive. *Hughes International (UK) Ltd., Glenrothes, Fife, Scotland.*

Plug-in latching relay

NEW addition to an existing range of relays is one which functions by the pulse-operated latching principle. It has two coils, main and release, which are continuously rated for d.c. or a.c. These operate up to three changeover contacts or five make-or-break contacts. The relay unit is fully tropicalised and is available, complete with transparent cover and plug-in socket, for £5 6s. Other relays in this "C and S" range include a latching relay with manual reset, magnetic blow-out types for breaking inductive loads and time delay units.

Supplied by the same distributors, the "Rodene" synchronous timer can be used for measurement of batch quantities such as required in large-scale concrete mixing. In this particular application several timers are connected in sequence. Each timer controls and times the release



of correct proportion of constituent. This proportion can be preset on the timer dial, which is calibrated in percentage. The process is initiated by a pulse to the first timer which, having timed the first constituent, sends an operating pulse to the next timer; so the cycle is repeated until the mixing hopper is filled. The system can also be applied to industrial process control. *D. Robinson and Co. Ltd., Gunnersbury Hse, 717 London Rd, Hounslow, Middx.*

Cheaper transistors

SUBSTANTIAL price reductions, up to one-third of original cost, came into effect recently for Semiconductors Ltd. transistors. The 2N501 high-speed switching transistor, for instance, now costs £2 9s compared with its previous price of £3 15s 6d. By increased adoption of automatic production methods, the company hopes to be able to cut prices still more in the future. *Semiconductors Ltd., Cheney Manor, Swindon, Wilts.*

Reference voltage unit

APART from laboratories, there are some production processes which use a Clark or Weston standard cell as a voltage reference. The disadvantage to these cells is, of course, that their life is not indefinite; moreover, the current output is of very low order, usually a few tenths of a milliamp. A recent mains unit to replace standard cells is the Convolt, which, connected to 115 V or 230 V a.c. 50 c/s supply, gives an output of approximately 1 V with a stability comparable with that of a standard cell. The current output is 10 mA and ripple content is less than 0.1 mV. Continuous operation with either short or open circuit will not harm the unit or upset its stability. The hermetically sealed metal case is only 2½ in. by 2½ in. by 3½ in. and the price is £16 5s. A 28 V d.c. model is also available at £14 14s. *Communications (Air) Ltd., Half Moon St, Bagshot, Surrey.*

Industrial local lighting

SPECIAL hinge joints which do not need adjustment and give 360° of movement are features of a new local lighting fitting, the "New Star," suitable for use on mains voltage with a 60 W lamp or for low voltage lighting through a transformer. The finish is in black and aluminium, the extended length 36 in. and the weight 5½ lb. Price, with uni-

versal base and switch, 99s; with alternative base, 88s. *EDL Industries, Brereton, Rugeley, Staffs.*

New electronic equipment

APEN-TYPE d.c. recorder with ten speeds of chart travel, each push-button selected and with an input impedance of up to 10¹¹ ohms, the "Enograph" is another useful addition to the development and research laboratory. Chart speeds range from 10 mm./sec to 20 mm./hr and the chart can be driven either from its own internal drive or from an external drive related to the machine on test. The recorder has facilities for linear or logarithmic indication and the whole instrument is of rugged design.

A useful range of transistorised converters with an output of 5 W to 120 W at 300, 250 and 200 V d.c. from 6 V to 24 V d.c. inputs, the small volume, low weight and infinite life expectancy of the new "Avel" converters will commend them to designers of electronic equipment requiring these voltages from battery sources.

For those engaged on circuit development in u.h.f. fields, a new fast repetition pulse generator will be of interest. An exceptionally versatile instrument, providing continuously variable repetition rates from 1 p.p.s. to 100,000 p.p.s., it has a number of special features which will appeal to the electronic development engineer.

The instrument, the Dumont Pulse Generator, Type 404, operates on normal supply voltages and has a nominal consumption of 600 W. All output controls are switch or push-button operated with front-of-panel mounting. *Aveley Electric Ltd., Ayron Rd, South Ockendon, Essex.*

Low voltage lighting

LOW price, robust construction and conformity with BS 794 are the main claims for the new low voltage transformers in the Gresham range. Three sizes, rated at 50 VA, 250 VA and 900 VA and with inputs of 200 V to 240 V in 10 V steps are listed at 51s, 90s and 225s in lots of 100. A choice of secondary voltages with centre tapping for earthing, 25-0-25 or 55-0-55 or non-standard voltages to order, make these transformers particularly attractive for machine tool lighting, handlamps in damp areas and similar applications where Factories Acts call for safe working voltages. The units can be supplied for wall, floor or bench mounting or with a carrying strap at slight extra cost. *Gresham Transformer Group, Twickenham Rd, Hanworth, Middx.*

More Aquastats

THE extensive range of Aquastat multi-function fast-acting boiler thermostats has been increased by the addition of no less than 18 new models, all of which have been specifically designed for the domestic central heating installation. Each unit, comprising thermostat, switching relays and transformers in a single casing, is designed to control simultaneously circulator pumps, oil burner

relays or gas pilot valves in conjunction with low or line voltage room thermostats.

Applied to a typical domestic heating and hot water system, it provides regulation of boiler temperature by controlling and oil burner or gas valve, relays signals to circulating pump whenever a room thermostat demands and incorporates limit safety control for the *Honeywell Controls Ltd., Ruislip Greenford, Middx.*

Transistorised telemetering

REMOTE control, indicating and metering systems using very frequency telegraph channels over or leased lines are now common in industry. Among the first fully transistorised equipments with high reliability and low consumption are Mullard BT.604 and BTR.708 systems.

The former is a digital transmission system working on a time-division multiplex principle transmitting up to 12 binary signals in any one VFT in each time cycle. These are divided into 12 groups of 13 bits for transmission of metering or indicating signals to a master station and several slave stations. The latter is an analogue converter for adding to the measurement where the parameter to be measured is in analogue form. It will scan analogues and present the information to the main unit in binary form. Both are designed to operate over 120 c/s a.m. or f.m. VFT channels, half of the channel being used for metering and indicating and the other half for control signals. For flexible construction and maintenance, the printed circuits are assembled as printed wiring boards. *Mullard Instrument Ltd., Torrington Pl, London.*

Boiler-feed motor pump

AN extension to the well-known "Mopump" centrifugal pumps, the new SC range incorporates all the basic features of its predecessor but has been scaled down to meet the requirements of the "package" market. They are available in five sizes with 1 in., 1½ in., 1¾ in. and 2 in. outlets, each size being made in a single or two-stage 1,450 r.p.m. fully motorised unit. Capacities are from 2 gall to 60 gall/min at pressures up to 250 lb/sq in. *Rhodes and Youatt Ltd., Stockport, Cheshire.*



The EDL industrial lighting unit is ideal for the workshop bench



"Mopump" boiler feed-pumps are available in either single or two-stage, operating at 2,900 r.p.m.

News of the Week

Transformer Price Agreement before R.P. Court

Ten Manufacturers defending right to fix Minimum Prices

N major transformer manufacturers, members of the Transformer Manufacturers' Association, are defending their right to fix minimum prices for their products in a case expected to last several weeks before the Restrictive Practices Court. The agreement before the Court involves 42 "restrictions" relating to sales within the UK, exports being the subject of another agreement, not before the Court.

The Association claim that its agreement satisfies the "public interest" criteria of the RTP Act in four respects. It protects the public against injury in connection with use of transformers; it brings substantial benefits to purchasers of transformers which would be lost if the agreement were abandoned; it is necessary to enable the members of the Association to negotiate fair terms with powerful purchasers (such as the CEBG area boards); and its abandonment would harm export trade in transformers. Members of the Association are AEI, Impton Parkinson, English Electric, GEC, Fullmer Electric, GEC, Hacklidge and Hewitt, Johnson and Phillips, C. A. Parsons and Bruce Peebles. Counsel for the Association, in opening the case, said that there were many other manufacturers of transformers in the country, but they were concerned with medium and small transformers, not the largest as were the members. Members of the Association had a substantial export business, most of it in large transformers, which brought in £8 million in 1959. By far the greatest part of the

industry's large expenditure on research and development was by members.

The price-fixing agreement, he explained, was limited to transformers sold for use in the UK. There were no quotas, but there were minimum prices, together with ancillary provisions.

On the question of the first two claims in defence of the agreement, the Association argued that abandonment of the agreement would bring great instability in the prices of transformers sold on the home market. There would probably be a sharp fall in profits, sustained for a long time.

Already profits from sales of transformers were unreasonably low. A further decline would be bound to affect adversely the industry's ability to spend on research and development and to expand its export markets. Efficiency would be impaired and costs would rise.

On the question of large buyers, the Association pointed to the predominating position of the CEBG, which in the absence of an agreement could enforce cuts in prices.

Transformer Manufacture in U.K.

THE Transformer Manufacturers Association, which is under consideration by the Restrictive Practices Court this week, represents ten of the largest manufacturers in the country. In addition there are 60 non-signatory makers, many of whom are small, and only 13 of these engage in export. The ten firms concerned are only manufacturers of large transformers above 60,000 kVA and together employ over 10,000 workers. Nearly £10 million annually is spent by TMA members on research and development. Some manufacturers are now prepared to build transformers for voltages to 525 kV. Export performance will doubt feature in the case presented to the court, for over the past five years members have exported 42% of all transformers received and for large units, the figure is as high as 56%. Altogether the TMA members claim to be responsible for 80% of all UK transformer exports. The home market 70% of transformers go to the supply industry.

GRUNDIG BY-PASS WHOLESALERS

GRUNDIG (Gt. Britain) Ltd. are changing their distribution methods, going direct to approved retailers and eliminating wholesalers as from this week. Alongside this change is a cut in prices. Aim of the move is to increase sales. The company state that they are "compelled to take this course to adjust policy to current market conditions."

S.E.B. plans £5m. voltage standardisation

THE Southern Electricity Board have decided to speed up standardisation of voltages. A new programme to spend £5 million over the next ten years on bringing all supplies up to 240/415 V and eliminating direct current supplies has been approved by the Board. At present there are about 180,000 non-standard supplies in the area, mainly at Bournemouth and Southampton. Many of the non-standard supplies are 200 V, so considerable outlay will be involved in bringing them up to standard. The

£180,000 acquisition by E.A.C.

THE Electrical Apparatus Co. Ltd. has three more wholly owned subsidiaries. The company already held minor holdings in Interohm Electrical Insulators Ltd. and Process Control Gear Ltd. and have now arranged to purchase the remaining shares in those companies. They have also purchased all the capital of Switchboards Ltd., which has works in St. Albans, and in addition to other items has developed a dual-door unit for service meters permitting external access. The latter firm was formed in 1951 with Mr R. H. Barbour, Mr D. R. Barbour and Mr J. R. Walton as directors. Interohm Electrical Insulators Ltd. started up in 1936 making asbestos cement boards for electrical purposes at a Felling-on-Tyne factory, but are now operating from Lowestoft. The works of Process Control Gear Ltd. are also in St. Albans. Total cost of these acquisitions is put at around £180,000.

PYE-EKCO MERGER

THE holding company formed for the proposed merger of Pye Ltd. and E. K. Cole Ltd. has the title of British Electronic Industries Ltd. Its chairman will be Mr C. O. Stanley, with Mr E. K. Cole as deputy chairman, but it is proposed that the identity of both groups will be maintained under existing managements. Terms of the merger were given in our 3 Nov. issue. It is now stated that aggregate net tangible assets of Pye and Ekco at book values at 31 March last amounted to £17,722,001, but the directors consider it is substantially below their present-day value.

In view of the unsettled TV market, directors say it is not practicable to make any firm forecast of profits for the current year, but unless there is a marked rise in sales, profits of both groups will be substantially lower. The board hopes to pay 15% dividend, the equivalent of that paid by both concerns last year.

decision to accelerate standardisation was prompted by the dilemma of having to connect a substantial number of new consumers to non-standard supplies, so that the longer standardisation was delayed the costlier it would become. During 1959-60, new non-standard connections amounted to 7% of the total increase in consumers. At the end of last March, 13% of all consumers in the area were on non-standard supplies, comprising 177,239 on a.c. and 7,394 d.c.

Engineers' Guild again reviews salaries

EARLY publication of a review of professional engineers' earnings during 1959-60 is promised by the Engineers' Guild in their annual report. Questionnaires were sent to 4,400 corporate members of the civil, mechanical, electrical and chemical engineers' institutions last April, and more than 70% of those approached replied.

The annual report of the Guild shows membership at the end of September last as 4,889, compared with 4,570 a year earlier. Activities during the year included pressure on the British Transport Commission to arrange for an impartial study of the remuneration of senior professional engineering staff. The report of the Guild says "on the evidence of recent years it is clear that a fair salary structure is unlikely to be attained until such a review has been carried out." So far the BTC had declined to arrange for a review of the type concerned.

Plans for next year include a conference on the theme "The Professional Engineer—His Employment and Development." This will have the aim of analysing the use being made of professional engineers today. One problem it may discuss is whether, because of shortage of technicians, professional engineers are regularly engaged on sub-professional work which may adversely affect their status and remuneration.

Credit Plan for Lighting, Heating

INDUSTRIAL lighting and heating on extended credit is being introduced by GEC in conjunction with Forward Trust, a subsidiary of the Midland Bank. The scheme, the first of its type, includes installation and wiring costs as well as capital equipment. Initial payment may be as low as 10%, with terms of six months to two years. It is planned to charge 5½% on £1,000, with lower rates for higher amounts.

TV Sales Recover

TELEVISION sales continued their gradual recovery in September, with the highest sales since the credit squeeze was imposed in April, but radio sales declined for the first time in many months. Shops sold an average of 7.7 TV sets each during September, compared with 5.5 in August. Rental agreements rose from 2.3 to 3.6 per shop. Radio sales were down to 13.2 in September.



At Manweb's "Service to Industry" exhibition at Liverpool, Mr D. H. Kendon, chairman (right) and Mr R. M. Gravett, assistant chief commercial officer, are seen watching a demonstration of a "Stellite" hard-facing process on a "Radyne" induction generator. All aspects of the service and advice available to industrialists are featured

Keeping heat inside factories

DOUBTS about heat loss calculations in factory heating design are discussed in a memorandum published by the Ministry of Power. It takes the form of a supplement to the explanatory memorandum on calculation of "U" values issued in 1958 in connection with the Thermal Insulation (Industrial Buildings) Regulations. Object of the present publication is to deal with apparent discrepancies between calculations based on, for example, the Institution of Heating and Ventilating Engineers' *Guide to Current Practice*, and figures reached by following the requirements of the Regulations.

The present memorandum explains that the Regulations require certain arbitrary figures to be used in calculations of "U" values, whereas other values may be appropriate to calculations made for particular design purposes. The memorandum includes a reminder that, fundamentally, the top standard of thermal insulation required for a factory roof is not based on a "U" value but on the criterion that loss of heat through the roof shall not exceed 12 B.Th.U./hr/sq ft when the outside temperature is 30°F. This criterion permits different "U" values depending on the inside temperature of the building.

Germanium rectifier order

THE General Chemicals Division of ICI has placed with the AEI Heavy Plant Division a contract for germanium rectifiers with a capacity of 32.4 MW at 270 V for the electrolytic production of chlorine. This is believed to be the largest order for semiconductor rectifiers ever placed by the chemical industry in the UK. The rectifiers are to work in parallel with a large number of motor converters and contact rectifiers (also of AEI manufacture).

Stockton works future

THE Stockton-on-Tees factory of Metropolitan-Vickers—Beyer Peacock Ltd. may have to close next year through lack of orders, we understand. For many months, the works have been busy on a £7½ million order for the construction of 113 electric locomotives for South Africa, but as this work nears completion the number of employees has been reduced from 600 to around 300. The local MP, Mr G. Chetwynd, is to ask Lord Chandos, AEI chairman, to clarify the position of the Stockton works.

OFFICIAL PUBLICATIONS

BS 2960. Dimensions of three-phase electric motors with ventilated enclosures. 6s.

BS 3283. Non-reversible connectors and appliance inlets for portable electrical appliances. 6s.

BS 2111. Fixed wire-wound resistors for use in telecommunication and allied electronic equipment. Part 1, general requirement and tests. 10s.

Thermal Insulation (Industrial Buildings) Act, 1957. Memorandum on calculation of "U" values. Supplement to the explanatory memorandum. HMSO. 3d (see page 818).

Comments on the Crowther Report; by Association of Teachers in Technical Institutions (see page 819).

Guide to Development and Export Financing Bodies. BEAMA. 4s.

Destruction of Newman Spinney

FINAL stage in the short career of the Newman Spinney experimental underground gasification power station begins next month when the structure itself is to be demolished. In the construction of the station, fly-ash from other power stations was used both for structural elements and cladding, and in some mortar. As originally planned, the structure is now to be tested to destruction to provide more information about the mechanical characteristics of such by-products of electricity generation. The chimney, too, is to be vibrated until it shatters.

Rail electrification films

STRIKING contrasts between highly mechanised techniques used by BR for their electrification programme and the extensive use of manual labour on a similar Indian scheme were illustrated by two well-produced colour films presented last week by BICC. Some of the problems overcome on the Midlands scheme were shown in "Power to the Pantograph." This film runs for 37 minutes and is available in 16 and 35 mm. "First a.c. Railway Electrification in India" runs for 30 minutes and is available in 16 mm only.

Technical teachers comment on Crowther Report

DETAILED comments on recommendations of the Crowther Committee in their report "15-18" are offered by the Association of Teachers in Technical Institutions in a new publication. The Association supports the Crowther Committee recommendation for more time to be made available for technical college courses. They suggest it is the duty of the Government to make training for skill compulsory for all occupations where it is appropriate.

It is the task of technical colleges both to continue the general education of young persons and also to teach subjects related to their employment. For the double purpose, the Association feels that more than one day a week is necessary. Increase in day release from 1½ to 2 days per week with not more than one evening attendance a week for boys and girls under 18 is recommended, but the Association finds itself unable to support without qualification the Crowther Committee opinion that only sandwich courses are satisfactory as a means of training technicians in the 16 to 18 age range. The Association feels that more experiment is necessary before there is any major change in policy. In particular, they think that day release is preferable to block release in nearly all cases, assuming block release to involve a period of continuous study followed by a period three or four times as long without study.

The Association comments also discuss such questions as the establishment

of county colleges, reasons for failure to complete technical college courses, place of the secondary technical school in the educational system and the supply of teachers.

Support Fund, says Sir Hamish

MORE support for the IEE Benevolent Fund was urged by Sir Hamish MacLaren at the East Midland Centre's annual dinner in Nottingham last week. At present, only one member in three was a regular subscriber, he said.

At the North Midland Centre's dinner in Leeds last Friday, Sir Linton Andrews, editor of the *Yorkshire Post*, said he believed that on balance science improved the quality of life. The Venerable Eric Treacy, Archdeacon of Halifax, asked whether enough thought had been given to the moral damage which science might do to people by diminishing the need to work.

MIDLANDS E.B. TO REORGANISE

THE seven sub-areas of the Midland Electricity Board are to be reduced to six. This is part of a long-term reorganisation plan that was announced this week. It is anticipated that the new arrangement will become fully effective by 1963.

The three-tier structure is to be retained and the reduction in sub-areas effected by amalgamating S. Staffs and N. Worcs with the Wolverhampton and district sub-area. It is also planned to reduce the number of districts from 36 to 31 by amalgamation: Stourbridge joining the Brierley Hill; Lichfield with Cannock; Stoke-on-Trent North with Stoke-on-Trent Central; Wednesbury with adjacent districts; and Leominster with Ludlow. It is stated that these amalgamations were planned for 1964 or 1965, but they may take place earlier or later according to circumstances. Some local adjustments of boundaries are also intended.

Canada forms Nuclear Association

THE Canadian Nuclear Association has been formed as a clearing house for ideas and to provide a means of liaison between the industry and Government. Organisations outside Canada are invited to join as associate members.

ATTRACTING THE BEST RECRUITS

IT was essential that the rapidly expanding electrical industry must attract the very best types of recruits, Lord Strathclyde, chairman of the North of Scotland Hydro-Electric Board told the Scottish IEE guests at the annual dinner in Glasgow last week. The Institution had performed a great role and had still a major part to play in guiding the industry into the future. Recruitment was far too low but the Government was alive to the danger and had announced plans which gave hope of increased training of technologists.

In reply, Sir Hamish MacLaren, IEE president, said the Institution had achieved the destiny visualised at its birth. He did not advocate amalgamation with the sister institutions, but commended co-operation in many fields and particularly in education. There might also be a strong case for co-operation in publicising the activities of the professional engineer about which far too little was known.

POWER FOR FORESTERS

ABOUT 1,100 of the houses owned by the Forestry Commission lack a supply of electricity, Parliament was told last week. However, the Commission hopes to have a mains supply laid on to all except the most remote of the houses within the next five years. This was stated by the Minister of Agriculture.

'25 kV a.c. Electrifies Suburban Service

A DOUBLING of receipts on British Railway's suburban services from Liverpool Street station is expected within a few years. This was forecast by Sir Brian Robertson at a luncheon following inauguration of the new services on 16 Nov., the occasion marking a further significant step forward in the railway's 25 kV, 50 c/s electrification scheme.

Sir Brian said that electrification of 111 track-miles serving the Chingford-Bishop's Stortford-Enfield area had not been achieved without hard work by BR's Eastern Region staff. Many problems had had to be solved, including the complete replacement of the track signal-

ling and telecommunications system. On top of this extensive civil engineering structural modifications had to be carried out; interruptions to existing train services were thus inevitable. But now patience and hard work would be rewarded by clean, fast and frequent trains. Frequency of the new service was, in some instances, over twice that provided by the original steam trains, with a corresponding improvement in timing. With electrification had come other amenities; five new stations such as Harlow and Enfield Town and improved lighting on all stations, notably at Liverpool Street.



An electric train from the new station at Broxbourne and Hoddesdon departing for Bishop's Stortford. On the left is the new signal box

CEGB To Make Radio Isotopes

ALTHOUGH the CEGB may irradiate materials to produce useful radio isotopes, it will be the UKAEA that will process them for sale. This was made clear during the debate on the Electricity (Amendment) Bill on Monday, when it secured a second reading. The purpose of the Bill is to give the CEGB power to produce radio isotopes for its nuclear reactors.

ABOUT £100,000 will be spent at both Bradwell and Hinkley Point to make possible production of radio isotopes.

After a brief debate which was universally favourable to the Bill, the Parliamentary Secretary to the Ministry of Power explained that Scotland was excluded from the provisions of the Bill because it still had powers of manufacture given under the 1947 Electricity Act. The 1957 Act had restricted the right

of the CEGB to activities in connection with research, development or repair and maintenance of CEGB or area board equipment.

At present 700 industrial firms in the UK were using isotopes and their application was spreading throughout the British industry. It is not anticipated that there will be any other customers than the UKAEA for a long time.

E.M.I. puts electronics into machine tools

ELECTRIC and Musical Industries Ltd. is co-operating with David Brown and Sons (Huddersfield) on the application of electronic techniques to machine tools. First fruit of this collaboration was an electronically controlled gear-hobbing machine exhibited at the Machine Tool Exhibition last June, the two companies have confirmed. Joint research is continuing and other machines and devices are on the way.

Welding Equipment Exhibition

AN EXHIBITION, "Focus on Welding," is being staged by the English Electric Co. at Kensington Court, London. Closing on 25 Nov., the exhibition comprises not only a static display of the company's range of electric arc-welding equipment but also practical demonstrations of its application to various welding techniques. For portable d.c. arc-welding supplies, equipment using a transformer in conjunction with a silicon diode rectifier bank is on show, this type having evidently completely superseded the motor-generator. Also attracting attention is a meter specially designed for measuring current, voltage and energy consumption of welding arcs. Among accessories displayed there is a choice of twenty-six different electrodes whose applications range from pre-heating to stainless steel welding.

RESUSCITATION FILM

A 16 mm. film on artificial respiration by mouth-to-mouth breathing is now available on hire from the Central Film Library. Produced by the University of Saskatchewan, it shows the various ways of carrying out the technique and how the method can be applied by trained personnel. (We reported on 17 March that the method had gained acceptance in the USA.) The film takes 27 min and can be hired for 15s.

M.E.B. APPLIANCE SALES FALL

MEB expect their turnover in contracting and appliances to be down £500,000 this financial year if the credit squeeze continues, the chairman, Mr W. S. Lewis, said in Birmingham last week. But the falling off in appliance sales has not been enough to cause a downturn in the demand for electricity, for already unit sales are up about 14% for the seven months to the end of October.

Mr Lewis was opening the new headquarters of Harold F. Ward Ltd., whose founder, like Mr. Lewis, had trundled a barrow laden with electrical equipment around Birmingham as an apprentice of Walker Brothers (Electrical Engineers). Mr Ward said the fears of unfair competition which electrical contractors held at the time of the supply industry's nationalisation had proved unfounded, and he felt much of this was due to Mr Lewis and his colleagues.

Eire Heating Plan

A COMPLETE "Warm Home" plan providing for the installation of an electric heating system in new or existing houses, with repayments spread over five years, is the latest scheme being strongly publicised by the Eire Electricity Supply Board. For new semi-detached two-storey, three bedroomed, 1,000 sq ft floor area houses they offer electric floor-warming, supplemented by other electric heaters in bedrooms and bathroom. For these, installation cost ranges from £103 to £135, including attic insulation, and the Board offers repayments ranging from £4 1s 9d to £5 7s 2d per two months.

In existing houses, electric storage heaters in the hall, kitchen and living rooms are suggested, with other types of heaters in bedrooms and bathroom. Again, with complete installation costs ranging from £102 to £160, the Board offer two-monthly repayments varying from £4 0s 11d to £6 7s. The storage heater in this scheme is a new streamlined model by GEC of Ireland which is available in attractive pastel colours.

Bungalow with a load

A BUNGALOW with 93 socket-outlets is obviously well provided for electrically. This one, just built at Stonely, Huntingdonshire, has 22.34 kW of floor-warming throughout its 1,900 sq ft of area, a Moffat electric cooker built into the wall and a separate counter unit with hotplate. All circuits are protected by miniature circuit-breakers and the bungalow has two hot-water tanks with immersion heaters, and garage doors which are electrically operated and remote controlled. Installation was by the Eastern Electricity Board.

N.W. WINDOW COMPETITION

WINNER of the North Western Electricity Board's 1960 window display competition was Rochdale service centre, in No. 5 sub-area. The display was mounted by Mr G. Ireland, senior service centre assistant. Entries in the competition numbered 102, the highest so far. On the theme of the merits of electric cooking, all the displays had to be produced on a small budget.

Rochdale chose the catchy slogan, "It's a matter of pounds, shillings and sense." Second place among the Board's six sub-area winners was Grange-over-Sands (No. 6 sub-area)—last year's winner—with Urmston (No. 1 sub-area) taking third place. Other sub-area winners were Bury (No. 2 sub-area), Hyde (No. 3 sub-area) and St. Annes (No. 4 sub-area).

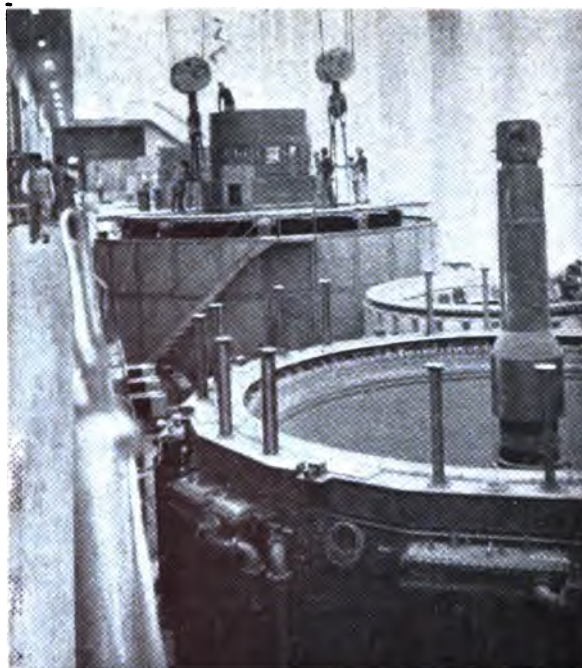


Winning display at Rochdale service centre, in the North Western Electricity Board's 1960 window display competition. The main theme, "Pounds-Shillings and Sense!" attracted favourable comment



FIRST BHAKRA STATION NOW IN SERVICE

First 90 MW waterwheel generators at Bhakra power in the Punjab, India, is now in operation. Our pictures, left, show the interior of the station and one of the turbines being erected. AEI have already delivered the five turbines to be installed in the power house built on the left bank of the River Sutlej. The associated Francis type water turbines were supplied by Hitachi, of Japan. The station was the scene of the inundation accident in August, 1959, it will be remembered, when five governors were submerged for weeks and a rotor suffered partial submersion. The latter was repaired by the "slow baking" process of passing a low current through them. The Bhakra dam is located in a gorge in the foothills of the Himalayas, where the River Sutlej cuts the last line of Siwaliks before entering the Indo-Gangetic plain. It forms a lake with a gross capacity of 7.3 million acre ft. It is planned to build a second power house on the opposite bank at a later date.



Diesel Exchange Deal

AN exchange agreement has been reached between Alco Products Inc. and Davey Paxman and Co. Ltd. The latter will have the right to make and sell Alco diesel engines outside the US and Alco can supply Paxman diesel engines and generating sets.

Supply for old property

ALTHOUGH scheduled for demolition in about two years' time as part of the Corporation's development scheme, 200 homes in one of the oldest parts of Gateshead are to be given an electricity supply. Previously, the North Eastern Electricity Board would not connect up the 70 years' old property, deeming it uneconomical in view of the impending demolition.

But the Board have now devised an economical method which will cost only about £13 per home. The families pay that at a rate of 2s 6d a week.

w E.E.B. Showrooms for St. Albans

First of the new buildings to the new Civic Centre at St. Albans is the showroom of the Eastern Electricity Board. Externally, the building is an excellent example for those with its long, modern window and the frontage with a curved reflecting window beneath a facade decorated by a mosaic panel depicting the legend of St. Alban. Internally, the showroom presents a clean open space in which goods are freely displayed against screens and curtains giving the floor area from the space. Flexibility is a keynote of the display layout, the sales area being divided by panels mounted on vertical

members which are set between the floor and ceiling members to form backgrounds to the display. The ceiling is also divided into panels which can be used to support lighting fittings or "spots" for display accent lighting, supply being from trunking above the panels. The cash counter at the rear of the showroom area is made interesting by a photo-montage of St. Albans as it was some years ago.

Underfloor heating is installed and favourable comment has already been made by visitors to the showrooms, both on the facilities provided and the manner in which the display has been laid out by the Board's showroom staff.



General view of the new EEB showrooms at St. Albans from the cash counter

CREDIT SQUEEZE STAYS

THE Government seems unlikely to ease credit restrictions just yet. Mr Macmillan told the National Union of Manufacturers last week that the Government ought not to do anything which might worsen the nation's trade balance. High home demand and declining exports militated against a relaxation of the credit squeeze, he said. This view was supported by the Information Division of the Treasury which says in its autumn review that the main danger in the UK economy is still insufficient overseas earnings. Income from employment accelerated in the quarter to June, with a rise of 3%, the bulletin states, but there are no figures to show the position now that redundancy has spread in the motor industry. Industrial production was steady in the three months to September, compared with the second quarter, a rise in engineering and capital goods having offset the fall in consumer durables, but the overall level of output was 6% higher than a year earlier. The credit squeeze has brought a shift in demand rather than a reduction, for consumer spending has been steady in recent months.

Consumers' Protection

THE establishment of a Consumers' Protection Council is included in proposals to safeguard the public in a Private Members' Bill being introduced in the House of Commons this week by Mr R. Edwards. It is expected to have its first reading on 27 Jan. Many of the provisions covering the sale of faulty or dangerous apparatus have already been recommended by the Molony Committee and the Home Office have been giving their attention to the preparation of material which might form the basis of legislation.

CREDIT RACE DANGER

IF a credit race were to develop in world trading, Germany's stronger balance of payments position would give her an advantage over Britain. This point was made by Mr L. C. Mather, joint general manager of the Midland Bank, at the BIM's recent conference on "Selling Capital Goods." Britain was succumbing to pressure for more export credit, Mr Mather said. Guarantees by the Export Credits Guarantee Department had risen from £57 million to £148 million in the past six years and maximum terms had gone up from five to seven years. If this trend continued, existing institutions might fail to meet the demand. As a remedy in such an event, Mr Mather suggested the setting up of a new export finance corporation which would raise funds by issuing securities. Other possibilities would be to make medium term paper guaranteed by ECGD rediscountable at the Bank of England, or eligible as security against advances to a discount house from the Bank of England so that banks could sell their holdings to the discount market.

Sayings

OF THE WEEK

"The official measures in the spring to check public spending were more in the nature of a thumb-screw operation for the domestic electrical appliances industry than a squeeze; it is still painful." . . . SIR IVAN STEDEFORD, chairman, Tube Investments, reporting to shareholders.

"Where we run into teething troubles on the new large boilers and turbo-alternators that we use, in most cases these troubles arise not from failure to advance in the major fields of design but simply from bad detailing due to the draughtsman having failed to learn what must be learnt on the shop floor if a man is to become a really good engineer." . . . SIR CHRISTOPHER HINTON, at W. H. Allen Sons and Co.'s presentations to apprentices.

"I do not think that the profit motive is a satisfactory one for the basis of education." . . . SIR ARTHUR THOMSON, at Birmingham University prize presentations.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, November 22

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	229½	+4	ZINC, virgin, min. 98% purity (cash) ...	88½	+½
" (3 months) ...	228½	+3	" (3 months) ...	87½	+½
LEAD, refined pig. 99.97% purity (cash) ...	67½	—½	RUBBER, per lb No. 1, RSS, spot ...	25½d	—1d
" (3 months) ...	68½	—½	c.i.f. basis, ports. Jan. ...	25d	—½d
TIN, refined, min. 99.75% purity (settlement) ...	800	—3	ARMOURING: Galv. Steel Wire (0.104 in.) ...	68	+½
" (3 months) ...	797	—2	Mild Steel Tape (0.04 x 1½ in.) ...	53*	—
ALUMINIUM, ingots 99.995% ...	186	—	NICKEL (home) ...	600	—
wire bars (4 x 4 x 54") ...	193½	—	MERCURY (76 lb flask) ...	70½	—
BRASS Scrap 63/37 ...	201	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
SILVER (Troy oz) ...	79½d	—	Lead. (New York) ...	12c	—

* Tape Price, now an average, includes varnishing

Injunction against E.T.U. refused

IN the High Court last Friday, Mr Justice Buckley refused to grant interlocutory injunctions to Mr L. A. Tuck, a member of the London Lift and Crane branch of the Electrical Trades Union. He asked for injunctions to restrain the ETU and its three chief officials from taking further steps in the election of delegates to the 1961 rules revision conference, and from publishing names of persons purported to have been nominated as candidates.

For Mr Tuck, Mr W. T. Wells, Q.C., alleged that the election was not being conducted in accordance with the union's rules. He maintained that there was delay in dispatching nomination forms to 78 branches in four divisions, which reduced electioneering time. In its elections it was the practice of the union to disqualify votes on the ground of delay, however trivial. If the current election was held and later declared invalid by the Court, the unsuccessful candidates would be exposed to criticism from the defendants, which would prejudice their prospects when the election was held afresh, he alleged.

Giving judgment, Mr Justice Buckley said he thought the nomination papers had been sent out two days late—that was of some importance. A prima facie case of infraction of the rules had been made out and to some extent this had prejudiced Mr Tuck. He did not think it proper, however, to prevent the union from going on with the proposed election—but it would do so at its own risk. If Mr Tuck continued with his action and was successful, he was unlikely to

be prejudiced at any future election held as a result of that trial.

The judge made no order save that there should be a speedy trial of the action.

Rubber and plastics research

A NEW combined research association of the rubber and plastics industries is to be established. Some 70 members of the British Plastics Federation have already agreed to support the new organisation, which will have the title of the Rubber and Plastics Research Association of Gt. Britain. Research will be carried out at the existing rubber research laboratories at Shawbury, near Shrewsbury, where extensions are under construction.

News in Brief

Next year's *Daily Mail* Ideal Home Exhibition will be held at Olympia from 7 March to 3 April.

Tynwald have approved application of Douglas TC to borrow £76,500 to purchase a diesel-generating set.

The Southern Electricity Board have opened new service centres at High St. Poole, and Ashley Rd, Upper Parkstone.

Avo Ltd. is to supply 1,750 Radiac survey meter trainers to the Ministry of Aviation.

The covered market, Carlisle, is to have electric floor-warming. A wooden floor incorporating heater wires will be laid over the present stone floor.

Over 350 members and their guests attended the annual ball of the Association of Electrical Machinery Trades at the Savoy Hotel on 11 Nov.

The BBC has placed a contract with British Insulated Callender's Construction Co. for a 500 ft aerial for the new Oxford TV and v.h.f. sound broadcasting station. The same firm is to supply a 500 ft mast for the Manningtree TV station.

£110 was raised for the EIBA funds at the dinner-dance of the South Wales branch recently.

Industrial vacuum plant

A SYMPOSIUM of papers on user-experience of large-scale industrial vacuum plant is to be held by the Institution of Mechanical Engineers on 1 and 2 March, 1961. It is planned to discuss some 12 papers, which will be preceded by a general review. Main objective is to provide an opportunity for designers and users of vacuum plant to discuss their problems and techniques, to the benefit of all concerned.

Company Activities

for the explosion over Dagenham in the form of US Ford's bid of £1 for each of the £1 Ordinary shares. British off-shoot, stock markets week would certainly have gone into a. An October trade gap, widened £76 million in the previous month £22 million, could only have acted down-drag on sentiment, for, though the tally clerks' strike exaggerated the deterioration in our export performance, it is quite clear that the on here is tending to worsen, not ve. Further, the proposed US cuts overseas spending are likely to lose some £20 million a year. Then, t a background of more motor ry sackings and short-time work- e Premier, addressing the National of Manufacturers, reiterated the nment's "no ease" policy with to the "squeeze." Yet, in spite of s, there was good firm business on exchange with the *Financial Times* rial ordinary index surging forward 311.0 to 314.9. And for that we can Henry Ford. The prospect of a injection of some £128 million of er money onto UK share markets, t critically short of stock could, l, have only one result. l this time electrical shares, too, in the joy-ride. Decca Record ed 3s 6d to 53s 9d after 55s, r Ordinary spun up 2s to 47s with " 2s 9d fresher at 43s, while GEC up 1s to 33 9d, English Electric s to 33s 9d and AEI improved 1s 3d. There were also a number of responses to specific items of news. British Thermostat, on renewed er talk, bounced up 4s 9d to

33s 3d but then, on the official denial put out by the board, they dropped back to 28s 9d. Plessey Co., who put some component or other into practically every British radio set, came home with profits much as forecast. For their boom year ended 30 June, 1960, they amounted to £4,300,884 before tax, against £2,236,119 in the previous year, while the total dividend has been raised—also as forecast—to 15½%, compared with 13% last time. News, however, that as a result of the credit squeeze the company is to lay off 350 workers knocked the 10s Ordinary shares 1s 3d to 46s before they recovered to 46s 6d, but still 1s 6d off over the week. A long way from their 1960 "high" of 43s 9d and last year's turned-down take-over offer worth 55s a share, the 5s Ordinary of Vactric started the week at 2s 9d but on the compulsory winding-up order from the Court fell away to 2s 7½d. Mixed feelings are experienced in the City on the latest annual report from Electric and Musical Industries in which, incidentally, the Americans are thought to hold about a quarter of the equity. Chairman Sir Joseph Lockwood notes that almost everywhere the pace of economic expansion is slackening and in many parts of the world it may soon give way to some measure of recession. In the circumstances, he adds, progress of the EMI group will inevitably be slowed down. But, on the other hand, his board is confident that there will be a "modest increase" in total sales this year, apart from any increase which must accrue from the additional companies.—*From our City Correspondent.*

ss Products

s of all four manufacturing divi- in the first quarter of the current vere well in excess of last year's , Mr E. J. L. Cotton, the chairman, i. In last year's record results all ns materially shared, with the switch division gaining special n. Turnover of that division in 0 was up by about 30% and profit- also increased, he adds. So far as rrent year is concerned, sales and book continue to be satisfactory, is not expected that the same ional expansion rate will be main-

pton Parkinson

out of the normal ranges of its from both home and overseas es was a record, but the growth fit was not evenly felt throughout mpany. The cable section was par- ly affected, but Mr Albert Parkin- chairman, anticipates a return to able profits now that the market

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	2,558,086	1,039,705	46	16	15/4	12/3
1957	2,729,404	1,079,564	47	16*	11/11	9/1
1958	2,989,218	1,134,715	33	12	14/1	8/3
1959	2,987,802	1,262,346	35	14†	15/6	9/5
1960	3,066,819	1,228,125	27	12½	15/7	11/3

*Plus 50% capical bonus. † Plus 25% capical bonus.

has a basis of some stability. The decline in profit by the cable section during the year ended 30 June last entirely offset the improved trading results by many other sections. Although a further intensification of competition generally is inevitable, he anticipates that the current year's results will compare satisfactorily with 1959-60.

Dowding and Mills Ltd.

Prospects for the current year are clouded by the difficulties of the motor and allied trades, Mr K. H. Sharp, the chairman, reports, but the company's business is well spread and, provided that

the recession does not become general, he hopes that the year's results will compare not unfavourably with those for 1959-60.

Drake and Gorham Ltd.

The £1 ordinary shares are to be sub- divided into 5s shares, and there is to be a rights issue of 500,000 5s ordinary at 8s 6d on a basis of four for each £1 ordinary held.

Electric and Musical Industries

Total group sales rose by 2% to £69 million in the year ended 30 June last. In the UK alone, sales rose by nearly 20%, but profitability is not yet satisfactory, Sir Joseph Lockwood, the chairman, reports. About one-half of group turnover was represented by gramophone records. Total sales by Morphy-Richards (recently acquired) in the period amounted to £12 million, with a net profit, before tax, of £1,234,000 compared with £675,000 in 1958-59.

Kalgoorlie Electric Power and Lighting Corp. Ltd.

For the 15 months ended 31 March last, net profit after all charges except taxation is £55,637 (£35,602 for the previous year), and a dividend of 7½% is being paid—the first since 1949.

Oliver Pell Control

For the year to 31 March last there was a net loss of £14,239 after a tax credit charge of £2,829, but the dividend remains at 6%. The previous year's operations brought a profit of £13,218.

Plessey Co. Ltd.

A final dividend of 8½% raises the total to 15½% for the year ended 30 June, against the equivalent of 13% last time. Consolidated profit increased to £4,300,884 (£2,236,119), reflecting not only a higher level of production, but rather more price settlements than usual in regard to long-term contracts.

Tube Investments

The Electrical Division felt the full effect of the h.p. restrictions and earnings were reduced, but the industrial installation equipment side of the Simplex business showed improved results in the year ended 31 July last,

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	14,615,922	5,271,209	61	13½	70/6	49/9
1957	15,650,685	5,510,909	64	15	70/9	49/9
1958	16,104,804	6,003,420	69	17½	86/-	48/-
1959	16,782,643	5,986,795	56	20	64½	71/6
1960	24,112,288	8,223,185	37	18½	7	64/1

Sir Ivan Stedeford, the chairman, reports. Other companies in the Division—Mersey Cables excepted—generally had a better year.

Intended Dividend

Elliott-Automation. Interim 5% (3½%) on larger capital.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

- 25 Nov.—Breconshire C.C.** Electrical installation in Upper Chapel C.P. School. Applications to County Architect, Rhyd Offices, Brecon, by above date.
- 25 Nov.—Dunbarton C.C.** Electrical work in lighting, underfloor heating and domestic hot water in proposed primary school, Seafar, Cumbernauld New Town. Applications to County Architect, J. Miller, Ferry Rd, Old Kilpatrick, by above date.
- 25 Nov.—Wembley B.C.** Provision and erection of 324 sodium and fluorescent Class "A" units and removal of existing columns.—See 17 Nov. issue.
- 26 Nov.—Alfreton U.D.C.** Installation of 134 Atlas 140 W sodium lamps and Stanton concrete columns.—See 17 Nov. issue.
- 28 Nov.—Armadale B.C.** (6) Electrical work in erection of 155 houses (49 blocks). Applications to Town Clerk, H. H. K. Clarkson, 4 South St, by above date.
- 28 Nov.—Campbeltown. N.A.T.O.** Common Infrastructure contract Slice VIII. Supply and installation of oil pumping equipment value £32,000: (a) four steam turbine driven pumps; (b) six motor driven centrifugal pumps of 22 and 50 c.m. hr; (c) one 50 c.m. hr screw pump; (d) one motor and one diesel 41 c.m. hr centrifugal pumps. Applications to Director General Navy Wks, Admiralty, Chamberlain Way, Pinner. Reference NWD/Infra/19, by above date.
- 28 Nov.—Eastwood U.D.C.** Provision of street lighting included in fixed price basis roadworks, Walker St. Surveyor, P. G. Rolling, Council Offices, Church St. Deposit £2 2s.
- 28 Nov.—Stockport B.C.** Supply of 850 Class "B" concrete street lighting columns.—See 17 Nov. issue.
- 29 Nov.—Londonderry B.C.** Supply of school equipment including: film projector, radio, record player, suds pumps, mobile resistance unit, variable capacitor, wattmeter, galvanometer and oscilloscope.—See 17 Nov. issue.
- 29 Nov.—Renfrew C.C.** (3) Electrical installation Drumshantie Junior Secondary School, Gourack. Applications to County Clerk, R. Urquhart, County Bldgs, Paisley, by above date.
- 29 Nov.—Woodbridge U.D.C.** Supply of one centrifugal pump with 10 h.p. 400 V motor. Water Engineer, Eden Lodge.
- 30 Nov.—Croydon B.C.** Electrical installation in Oval School.—See 17 Nov. issue.
- 30 Nov.—Dundee.** (b) Lighting, power and signal systems in proposed extension to Maternity Dept, Dundee Royal Infirmary. Applications to Regional Engineer, Eastern Regional Hospital Board, "Vernonholme," Riverside Drive, Ninewells, by above date.
- 30 Nov.—Durham C.C.** Renewal of electrical installations in: Birtley George St County and Modern schools; West Stanley Front St County School. (a) Electrical alterations and additions at Haverton Hill County and Modern schools. (b) Electrical installation in Peterlee Shotton Hall new Modern School. Drive lighting installation at Windlestone Hall Residential School. Applications to County Architect, South St, Durham, by above date.
- 30 Nov.—Hampstead B.C.** (1) Supply of lanterns and ancillary equipment for colour corrected mercury lighting; (2) supply and erection of Group "A" specified tubular steel columns, installation of equipment in contract 1 for 5½ miles of Group "A" lighting. The latter contract also includes the removal of existing Group "B" lighting.—See 17 Nov. issue.
- 1 Dec.—Chesterfield B.C.** Supply of: (1) 88 25 ft tubular steel columns and one wall bracket; (2) 71 140 W sodium Group "A" lanterns; (3) 18 3 by 80 W fluorescent lanterns and 18 400 W colour corrected mercury lanterns complete with lamps/gear; (4) 71 140 W sodium lamps/jackets/gear for A61 Exeter-Leeds Trunk Rd lighting.—Advertised 17 Nov. issue.
- 2 Dec.—Braintree and Bocking U.D.C.** (1) Erection of 112 Group "B" prestressed concrete columns; (2) supply, erection and wiring of 115 45/60 W sodium lanterns; (3) laying cable ducts; (4) dismantling existing installation; (5) incidental works.—Advertised 3 Nov. issue.
- 2 Dec.—Whitchurch U.D.C.** Installation of wiring and o/h tracks included in alterations to provide slaughter hall at public abattoir. Engineer and Surveyor, Pauls Moss, Dodington. Deposit £2 2s.
- 3 Dec.—Cambridgeshire C.C.** Supply, erection, wiring and fitting: (1a) nine 35 ft steel columns with 200 W sodium lighting at Caxton Gibbet roundabout (A45 and A14); (1b) eight 35 ft steel columns with 200 W sodium lamps at Four Went Ways roundabout (A11 and A604); (2) five 25 steel columns with 3 by 80 W fluorescent lamps at Bury Toll junction near Newmarket (A11 and A45).—Advertised 10 Nov. issue.
- 3 Dec.—Colwyn Bay B.C.** (Contract 1) Supply and installation of 99 Class "A" concrete columns and sodium lanterns; (2) supply of 480 Class "B" concrete columns; (3) supply of 480 60 W sodium lanterns/gear; (4) supply of 270 time switches; (5) erection and installation of 270 time switches; (6) cable duct laying; (7) removal of existing gas lamps. Borough Engineer and Surveyor, H. Wilman, Whalley Range, Lansdowne Rd.
- 3 Dec.—Huyton with Roby U.D.C.** Applications invited for inclusion in selected list for (Tender 12) public lighting equipment to Engineer and Surveyor, Council Offices, Derby Rd, Huyton, by above date.
- 3 Dec.—Kingsbridge R.D.C.** Rewiring of Manor Hse. Council Clerk: J. H. Savidge.
- 3 Dec.—Swansea B.C.** Electrical installation in proposed primary school at Sketty Pk, Swansea. Applications to Borough Architect, Guildhall, by above date. Deposit £5.
- 3 Dec.—Tandragee U.D.C.** Fluorescent street lighting installation. Engineer and Surveyor's Dept., Town Hall, Banbridge. Deposit £3 3s.
- 5 Dec.—Chigwell U.D.C.** (i) Supply of (a) 21 steel columns and (b) lanterns/lamps; (ii) erection and installation of 21 200 W sodium units for A11 No. 2 lighting scheme.—See 3 Nov. issue.
- 5 Dec.—Eccles B.C.** Electrical installation in: (1) 40 houses, New Hall Ave; houses, Scott Ave. Engineer and Town Hall Annexe, Irwell Pl. Deposit £3 Nov. issue.
- 5 Dec.—Manchester C.C.** Supply and installation of outside lighting of existing plant at Davyhulme Sewage Wks. Deposit £3 Nov. issue.
- 5 Dec.—York T.C.** Supply and installation of two 1,867 g.p.m. centrifugal pumps for recirculation pump-house at Sewage Purification Works.—See issue.
- 7 Dec.—Evesham B.C.** Supply and installation of: (a) 33 30 ft tubular steel with 200 W sodium lighting along A20 existing columns converted to sodium along A433; (c) 41 25 ft steel columns with 140 W sodium gear, along A44. Borough Surveyor, High St. Deposit £2 2s.
- 8 Dec.—Heston and Isleworth B.C.** and erection of 41 Group "A" steel with mercury colour corrected lanterns/gear and removal of 28 columns along Vicarage Farm Rd low. Borough Engineer's Dept., 88 Rd, Hounslow. Deposit £2 2s.—A in this issue.
- 8 Dec.—Swansea B.C.** Supply of o.d.c. generator.—See 17 Nov. issue.
- 12 Dec.—Downpatrick R.D.C.** work in two blocks of four-storey nettes and one block of three-storey person flats in Windmill St, Ball. Details from architects: Munce and 133 University St, Belfast. Deposit £5.
- 12 Dec.—Grimsby B.C.** (c) Electric installation, on fixed-price basis, in re South Parade Primary Junior Borough Engineer and Architect Oldfield, Municipal Offices, Town Deposit £5.
- 12 Dec.—Manchester C.C.** Supply and installation of passenger lift in City of Juvenile Court, Minshull St. City Engineer, P.O. Box 488, Town Hall.
- 12 Dec.—Stockport B.C.** 2. Electric installation proposed Welfare Clinic, 100 Rd West, Reddish.—See 3 Nov. issue.
- 12 Dec.—West Hartlepool B.C.** installation in 16 old people's flatlet Manor estate. Borough Architect, 1 Bldgs.
- 13 Dec.—Kirkcaldy T.C.** (b) Electric installation of new hall at Links 3 Nov. issue.
- 14 Dec.—Matlock U.D.C.** Supply and

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries.

A Selection from the 109 queries answered this week

"Vicalloy" permanent magnet alloy—makers of? C.E.F.—Telegraph Construction and Maintenance Co. Ltd., Telcon Wks, Manor Royal, Crawley, Sussex.

Electric firelighters—makers of? T.E.—Lupus Electrical Products Ltd., Lupus Wks, Oxford Rd, Altrincham, Cheshire; Kinder Electric Co. Ltd., The Greys, High St, Harlington, Middx; The General Electric Co. Ltd., Magnet Hse, Kingsway, W.C.2; Hockley Electric Co., 56 Great Hampton St, Birmingham 18.

"Apex" washboilers—makers of? S.E.E.B.—Lamb Hingley and Co. Ltd., Stour Wks, Stourbridge, Worcs.

"Defromatic" automatic defroster for refrigerators—address for? N.W.—Waldy

(London) Ltd., 17 Tottenham Court W.1.

"Syntron" vibrators—makers of? —Riley (IC) Products Ltd., 19 W Pl, W.C.1.

"E.F.E." in design, switches—makers of? T.L.—E.F. Electric Ltd., Willo Watford, Herts.

"Tel" infra-red grills—address L.E.B.—Brattel Electric Co. Ltd., 2 Bond St, W.1.

"Sternette" refrigerators—makers T.B.C.—L. Sterne and Co. Ltd., 1 Ave, Hillington, Glasgow.

"Schick" electric shavers—address N.W.—Schick Incorporated (U.K.), 86a Brook St, W.1.

complete of nine sewage pumps at pumping stations in Darley Vale.—See 10 Nov. issue.

ec.—Waterford C.C. Supply and erection of two 20 g.p.m. pumps and 380 V motors for Kill and Bonmahon water supply scheme.—See 17 Nov. issue.

ec.—Sunderland B.C. Electrical installation in Maternity and Child Welfare Clinic, on Castle estate. Borough Architect, Hse, Stockton Rd.—Advertised in issue.

Dec.—Wandsworth B.C. (h) Supply of (i) electrical works for year from April, 1960. Borough Engineer, Municipal, S.W.18.

Dec.—West Lothian C.C. Supply and erection of 31 200 W sodium lanterns on 35 steel columns with 10 ft 6 in outreach for A89 Starlaw and A8/A899 Broxburn lighting. County Electrical Manager, 212 High St, Linlithgow.

Dec.—Fareham U.D.C. Supply and installation of sewage pump, complete with motor control gear for Peel Common. Engineer Surveyor, Westbury Manor, Fareham, Hants.

Jan.—Dumblane B.C. Supply and erection seven Group "A" concrete columns/rafters/auxiliary equipment, plus the re-erecting of six columns along A9.—See 10 Nov. issue.

eb.—Oxford T.C. Supply and erection of

two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. issue. No date stated—North of Scotland H.E.B. 33 kV switchgear for Burghmuir substation, Perth.—Advertised 17 Nov. issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

30 Nov.—Burma. Clocks, fire alarms, fans, conduit fittings, wire, cable, switchgear, etc. National Housing and Town and Country Development Board, Rangoon. B.o.T. (ESB/29427/60/ICA).*

30 Nov.—Norway. N.A.T.O. Infrastructure contract, value £18,000, nine 12.5 kVA diesel-alternators. Applications to Forsvarets Bygningstjeneste Seksjon 2, Postboks 967, Oslo, by above date. B.o.T. (G.D.6722/59/15).*

5 Dec.—America. Disconnect switches and fuses, eight items. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Contract Purchasing Unit, Bldg 53, Denver Federal Center, Denver, Colorado. B.o.T. (ESB/29440/60).*

6 Dec.—Rhodesia and Nyasaland. Nine earth resistance testers. Town Clerk, P.O. Box 990, Salisbury. B.o.T. (ESB/304083/60).*

7 Dec.—Canada. Supervisory control panel and carrier current control equipment. Chairman, Committee on Utilities and Personnel, c/o City Clerk, Winnipeg 2. B.o.T. (ESB/30085 and 6/60).*

8 Dec.—Pakistan. Switchgear, h.t. and l.t. Directorate of Supply, P.I.D.C. Hse, Dacca 2. B.o.T. (ESB/29397/60).*

12 Dec.—India. Energy meters. Chief Engineer (South), Stores Purchase Section, The Mall, Patiala. B.o.T. (ESB/29462/60).*

13 Dec.—Thailand. 100,000 lb base all-aluminium conductor; 3 million ft seven-strand all-aluminium polyethylene-covered conductor and tie wire. Metropolitan Electricity Authority, Chakraphet Rd, Bangkok. B.o.T. (ESB/28861/60/DLF).*

14 Dec.—Rhodesia and Nyasaland. 5,000 30 A m.c.b.'s, complete with red shrouds and h.t. cable box compound. Town Clerk, P.O. Box 591, Bulawayo. B.o.T. (ESB/30484 and 5/60).*

14 Dec.—S. Africa. One air conditioning plant. Secretary, Union Tender Board, 291 Bosman St, P.O. Box 371, Pretoria. B.o.T. (ESB/30435/60).*

19 Dec.—India. 2,120 s.- and three-phase time switches. Chief Engineer (South), Stores Purchase Section, Punjab S.E.B., The Mall, Patiala. B.o.T. (ESB/29466/60).*

19 Dec.—New Zealand. Synthetic enamel insulated copper wire and resistance wire. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/29418/60).*

22 Dec.—Egypt. Machines and equipment for electrical section of railway diesel shops, Bulak. Mechanical and Electrical Eng. Dept., E.R., New Collective Bldg, Shoubra Bridge. B.o.T. (ESB/29372/60).*

26 Dec.—India. 47 multi-panel 11 kV switchboards. Chief Engineer (South), Stores Purchase Section, Punjab S.E.B., The Mall, Patiala. B.o.T. (ESB/29467/60).*

5 Jan.—India. Testing and indicating instruments. Chief Engineer (South), Stores Purchase Section, Punjab S.E.B., The Mall, Patiala. B.o.T. (ESB/29469/60).*

7 Jan.—Bolivia. Provision of a 5 MW power plant and supply undertaking for Santa Cruz. Comité de Obras Públicas de Santa Cruz, Propuesta a la Convocatoria a Propuestas 2/60, Casilla 218, Santa Cruz de la Sierra. B.o.T. (ESB/29400/60).*

23 Jan.—Egypt. 66 kV a.s.c.r. conductor transmission lines for fourth extension Delta Scheme (1) Abbassa-Ismailia; (2) Zagazig-Benha; (3) Hanout-Abu Kebir; (4) Drain 3-Borollas. Director-General, Technical and Electrical Dept., Ministry of Public Works, Cairo. B.o.T. (ESB/29449/60).*

CONTRACTS PLACED

arley B.C. Electrical installation at St. Mary's Secondary Modern School, N. G. and Co. Ltd., £10,164. Recommended.

Edison U.D.C. Supply and erection of concrete and 105 steel Group "A" columns complete with lanterns/gear, along and at A129, Abacus Municipal Ltd.

G.B.—Contracts placed during the month amounting to £16,750,000 in—Blyth B power station: control and instrumentation for units 5 and 6, Evershed & Sigoles Ltd.; condensing plant for 7 and 8 (350 MW) turbo-generators, Hargreaves and Co. Ltd., two 350 boilers, Clarke, Chapman and Co. Thorpe Marsh power station: piling at No. 2 and foundations for main unit No. 2, Holloway Bros.

on Ltd. coal and ash handling, cooling water systems, earthworks, bridges for main sidings, Mitchell Condon Co. Ltd. Drakelow C power station: booster pumps and starting and boiler feed pumps for 375 MW No. 11, G. and J. Weir Ltd.; two 12 MW turbo-generators, Nos. 9 and 10, feed heating and evaporating plant and feed pumps, English Electric Co. Ltd.

haw power station: 415 V switchgear accessories for units 4, 5 and 6, English Electric Co. Ltd. Sizewell nuclear power station: 200-ton derrick crane, N. V. Inefabriek Hensen. Belvedere power station: superstructure works, M. J. Gleeson (Contractors) Ltd. Northfleet power station: dust handling plant, Babcock and Wilcox Ltd. Bankside power station: superstructure, Higgs and Hill Ltd. West Thurrock power station: High pressure pipework valves for No. 3 and 4 units, Stewarts & Lloyds Ltd.; extension of ash and dust lifting plant, Babcock and Wilcox Ltd.

er Darwin substation: two 132/33 kV, 15 MVA transformers, Bruce Peebles and Co. Ltd. Stockport substation: one 45 MVA transformer and ancillaries, Ferranti Ltd. Elstree substation: two 40 MVA synchronous condensers, Associated Electrical Industries Ltd. Whitson substation: 132 kV auxiliary cables, Pirelli-General Cable Co. Ltd. Thorpe Marsh power station: 132 kV overhead line, J. L. Eve Construction Co. Ltd. Corby-Staythorpe/Sundon: 132 kV overhead line, Watshams Ltd.

E.G.B. (Eastern, London and S.E. England). Contracts placed, of over £5,000, during September and October include: re-erecting 33 kV switchgear mods., A. Reynolds and Co., £5,187; Chelsfield, 132 kV,

33 kV cabling, B.I.C.C. Ltd., £10,644; Hartley, 132 kV switchgear, English Electric Co., £23,349; Leigh, 33 kV switchgear, A. Reyrolle and Co., £11,357; Elstree, 132 kV cabling, B.I.C.C. Ltd., £27,318; Goldington, interrupting equipment, G.E.C. Ltd., £5,731; Goldington, 132 kV switchgear mods., A. Reyrolle and Co., £9,447; Stanmore, 33 kV cabling, Pirelli-General, £7,931; Sundon, civil works, J. E. Eve Construction Co., £19,917; Paddington—Moscow Rd, 66 kV/22 kV, 45 MVA transformers, Ferranti, £92,424; Goldington 132 kV switchgear uprating, A. Reyrolle and Co., £30,297; Peterborough, 132 kV switchgear, A. Reyrolle and Co., £42,401; Brimsdown, 33 kV switchgear mods., A.E.I. Ltd., £51,037; Hornsey, laboratory mods., F. Smith and Co., £5,533.

Durham C.C. Electrical installation in Brandon residential nursery, T. Mitchelson (Electrical) Ltd., £851 8s 1d.

TRADE NOTES

BEAMA Contract Price Adjustment Formulae. For Electrical Machinery and Equipment. For purposes of calculating variations in (a) "Rates of Pay"—the rate of pay for adult male labour at 18 Nov., 1960, shall be deemed to be 204s 6d; (b) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 18 Nov., 1960, is 116.2* (180.3*).

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (a) "Rates of Pay"—the rate of pay for adult male labour at 18 Nov., 1960, shall be deemed to be 204s 6d; (b) "Cost of Material"—the index figure for materials used in the Mechanical Engineering Industry at 18 Nov., 1960, is 126.1* (189.4*). "Blast Furnaces and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)," 189.5*. Other Steel Goods, excluding tubes (1958 S.I.C. ref. 311/2), 129.1*. The price of brass condenser tubes 1/2 in. o/d 18 s.w.g. on 10 Nov., 1960, is 3s 11 1/2d per lb. *Provisional figure.

The figures in parentheses shown above relate to earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954=100.

Agents. Elliott Bros. (London) Ltd. have

been appointed exclusive representatives in the British Isles for sale of the "Airbrasive" unit for cutting and abrading hard, brittle material. The tool is a product of S. S. White Industrial Division, New York City.

Change of Address. Pipework and Engineering (Bristol) Ltd. are shortly moving to Poole, Dorset, and will vacate their premises at Stanley St South, Bedminster, Bristol, at the end of November. From 1 Dec. until arrangements for the transfer are completed, the registered office will be 115/119 West St, Bedminster, Bristol 3.

New Showrooms. W. N. Froy and Sons Ltd. have opened new showrooms at Farman St, Hove, to display a wide range of household equipment. It includes an electrical section.

New Store. British Insulated Callender's Cables Ltd. have opened new stores at 30 Tolbooth St, Kirkcaldy. Telephone: Kirkcaldy 3641.

Representatives. Crater Products Ltd. have appointed representatives in the London, Birmingham and Manchester areas. They are: E. R. F. Collier, 18 The Ridgeway, Enfield; B. D. A. Woolley, 47 Peakhouse Rd, Birmingham 22A; and G. B. Tonge, 131 Hillfoot Rd, Hunts Cross, Woolton, Liverpool.

BUSINESS PROSPECTS

Andover. Holland and Hannen and Cubitts, 1 Queen Anne's Gate, S.W.1, contractors for £1½ million Ilford Ltd, factory.

Barnstaple. Devon C.C. plan £36,000 training centre and £27,000 hostel. County Architect, 97 Heavitree Rd, Exeter.

Bath T.C. Tender: Second instalment of new Technical College comprising 66,000 sq ft and caretaker's house. Architects, Frederick Gibberd, 19 The Rows, Stone Cross, Harlow, Essex.

Bexley B.C. Modernisation of street lighting in all streets not in present comprehensive street lighting scheme.

Billinge and Winstanley. Church of England authorities plan new school on Blackleyhurst Hall Farm land.

Birmingham. Regional Hospital Board, approves schemes: Admission unit and outpatients' centre at Rubery Hill Hospital at £327,930; male nurses' home at Chelmsley Hospital, Marston Green, £19,890; pathological laboratory improvements, Marston Green Maternity Hospital, £15,600, etc.

Bishop Auckland. M. C. Robson and Son, Station Chmbrs, architects for office block at South Church Rd for Wilson's Foundry and Engineering Co.—Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, architects for preliminary training school at General Hospital.

Blackburn B.C. Lighting for portion of Burnley Rd planned.

Blackpool. Preston Dairies, Watling St Rd, East Fulwood, Preston, plan industrial development on Collins Ave land.

Bradford. Bierley La hostel for mentally disordered planned by Corporation.

Bromley B.C. Tender: Three-storey block of 15 flats, Chatterton Rd. Engineer.

Caernarvon. Ferodo Ltd, Chapel-en-le-Frith, plan factory on banks of Menai Strait at Griffiths Crossing.

Calster R.D.C. Tender: Six houses Nettleton. Architects, Wm. Saunders and Ptnrs, 24 Castle Gate, Newark on Trent.

Cambridge. E. Anglian Regional Hospital Board plan rewiring of Bourne Isolation Hospital, at £5,000.

Cardiff. Corporation Welfare Committee plans £56,000 home for aged at Llanishen.

Carlisle. Metal Box Co., Baker St, W.1, plan training school at Borland Ave.

Cheltenham. Neata Products, Cheltenham, plan 15,500 sq ft storage building, Churchill Rd.—Walker Crossweller and Co., Clyde Cres, plan 6,000 sq ft extensions.

Croydon. Welfare Services Committee plans home for 50 old people on Monks Hill Estate at £65,000.—Whitgift Educational Foundation, North End, plan demolition of existing Trinity School buildings and erection of offices, shops, restaurant, drive-in bank and multi-storey garages.

Cumbernauld. Development Corp'n. Tender: 384 two-storey houses and 101 flats, Carbrain 1 and 2 housing site. Chief Architect and Planning Officer, Cumbernauld Hse.

Dagenham B.C. Traffic signals planned at Ballards Rd/Oval Rd North junction.

Darlington. Chemical and Insulating Co, Darlington, plan new engineering workshops at West Auckland Rd.

Doncaster. New High Melton Training College planned.—R.D.C. Armthorpe and Sprotborough blocks of flats for old people, 25 in each block, planned.

Dovercourt. Methodist Homes for the Aged plan conversion of Alexandra Hotel into old people's home.

Durham C.C. Nursery school planned at Park La, Winlaton. Architect, D. Wise, 26 Osborne Rd, Jesmond, Newcastle.—R. Brown, 123 Victoria Rd, Darlington, architect for modern Wingate school.

Edmonton B.C. Tender: Nine-storey block of 40 maisonnettes, etc. Architect.

Enfield. A. M. Freeman, 72 New Bond St, W.1, architects for £200,000 extensions at Great Cambridge Rd for Gor-Ray.

Esher. Solartron, Queens Rd, Thames Ditton, plan conversion of works.

E. Suffolk C.C. Tender: Bawdsey V.C.P. School, alterations and extensions. Architect.

Fallsworth U.D.C. Tender: 50 Brierley Ave houses. Engineer and Surveyor.

Felling. William Leech, St. James St, Newcastle, plan 139 houses, S. Wardley Farm.

Gateshead. Greensitt Bros, 18 Nixon St, Newcastle, plan eight shops, flats, etc., at corner Durham Rd and Albert Drive.—C. Solomon, 30 St. Mary's Pl, Newcastle, architect for showrooms at High St, for Simmons (Furnishers).

Glasgow. Stokes and Dalton, 470 Gallowgate, Glasgow S.E., plan building at 89 French St.—J. Thomson and Son, 29 Strathcona Drive, W.3, plan rebuilding and enlarging workshop and offices.—William Beardmore and Co. plan offices, canteen at Parkhead Forge, Duke St, E.1.—Industrial Estates Management Corporation for Scotland, Woodside Terr, C.3, plans single-storey extension to factory.

Harrow. London County Welfare Committee plan £98,155 extension of homes at Blythwood for old people.

High Wycombe. Brocklehurst, Cooper and Williamson, Tudor Hse, High St, High Wycombe, architects for stage three of factory and offices for Stephens and Carter.

Hull. The Humber Electrical Engineering Co, 45 Portland Pl, Hull, plan three-storey office block at Portland St and Portland Pl.—H. D. Priestman, 101 Spring Bank, architect for home for aged, Grove Hse estate.

Jarrow. T.C. plans nine-storey blocks of flats in Market Sq area. Engineer.—Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, architects for Newcastle Hospital Board's planned extensions to Danesfield Maternity Home.

Lanarks C.C. Tender: Electrical work in two schools, Chapelhall and Calderhead. Clerk.

Leeds. £290,000 scheme for electrical power installations in 22,000 Corporation dwellings. Corporation Housing Committee.

Liverpool. R.C. authorities plan Notre Dame secondary selective school at Stonebridge La.—Tenders accepted by Housing Committee total £4 million. New scheme includes 14-storey blocks at Kirkby and Huyton.

London.—C. P. Roberts and Co, 31 High Holborn, W.C.1, plan £40,000 warehouse and offices, Great Eastern St, E.C.2.—J. Keyes, 13 Wimpole St, W.1, architect for home and hospital for Jewish Incurables planned at Tottenham, N.15.—Knapton and Deane, 6 Martins La, E.C.4, architects for offices at 24 King William St and Crooked La, E.C.—H. Owen Luder, 79 Regency St, S.W.1, architect for shop/offices on site of New Cross Rd, Century Cinema, S.E.14.—Richard Ellis and Son, 165 Fenchurch St, E.C.3, surveyors for 22-storey block of Grosvenor Rd flats, S.W.1.—R. Seifert and Ptnrs, 28 Great Ormond St, W.C.1, architects for offices on sites of 77-83 Upper Richmond Rd, S.W.15.—Sir Launcelot Keay, Basil G. Duckett and Ptnrs, 22 Oldbury Pl, W.1, architects for £200,000 block of luxury flats, junction Lowndes St and West Halkin St.—Tersons, contractors for £1½ million apartment house Nutford Pl, W.1. Architects, Newman Levinson and Ptnrs, 9 Mansfield St, W.1.

Lowestoft. Posford, Pavey and Ptnrs, Abbey Hse, Victoria St, Westminster, S.W.1, consulting engineers for 42-acre site development for Boulton and Paul.

Luton. United Dairies, 34 Palace Court, Bayswater, W.2, plan workshop and offices.—Central vehicle repair and maintenance workshops and transport garage at Kingsway planned. Borough Architect.

Macclesfield. Henshaws Institution for the Blind (Office of Charity), Old Trafford, Manchester 16, plan £½ million school for the blind at Chelford, Cheshire.

Manchester. Salford R.C. Diocesan Trustees plan secondary school at Brantingham Rd, Whalley Range.

Middlesbrough. Elder and Lester, 65 Albert Rd, Middlesbrough, architects for flats at The Crescent for North-Eastern Land Holdings.—Dorman Long and Co. plan apprentice training centre, Britannia Works.

Morpeth. Newcastle Hospital Board, Benfield Rd, Newcastle, plan extensions to administrative offices and nurses' training school at Northgate and District Hospital.

Motherwell. Honeywell Controls plan £½ million factory extensions at Newhouse Industrial estate.

Newcastle. Minorities Garages, Jesmond Rd, plan showrooms, stores, etc., on five-acre site at Cremona Park. Architects: Waring and Netts, 36 Jesmond Rd.

Norwich. E. Anglian Hospital Board plan £4,849 electrical rewiring of first and second floors at Whitlingham Hospital.

Nottingham T.C. £1,445 improved street lighting planned, Woodborough Rd.

Notts. C.C. Welfare Committee plans homes for the infirm at Mansfield, Woodhouse and Sutton-in-Ashfield.—Health Committee plan £62,000 training centre, Newark.

N. Riding C.C. Tender: Alterations to Lealholm County School. Architect.

Peterborough. Union International, 13 West Smithfield, E.C.1, plan abattoir at Padholme Rd.—W. Winder and Son plan purchase of 2½-acre site Padholme Rd from corporation for industrial estate.

Redditch. Lan-Bar, 19 Seymour St, Calthorpe, Birmingham 12, plan Arthur St factory and offices.

Richmond. Conversion of gas lighting to electric at £2,400 planned, Richmond Bridge.

Rochford R.D.C. Tender: Two pairs three-bedroom houses, Oakleigh Ave, Hullbridge, and a pair of two-bedroom bungalows, High Elms Rd. Clerk.

Safron Walden. R. H. Turner, 96 Coombe Rd, New Malden, Surrey, architect for £120,000 Church Training College planned by British and Foreign Bible Society.

Salisbury and Marske U.D.C. £23,406 street lighting scheme planned, using 250 or 400 W mercury vapour lanterns on 25ft concrete columns. Engineer.

Scarborough. T.C. plans £6,090 electrical installations in 170 houses.

Scunthorpe. Richard Thomas and Baldwins, 47 Park St, W.1, plan engineering block, Redbourn Wks, Dawes La.

St. Helens B.C. Tender: Contract 2160; 75 dwellings, Greenbank, No 2 redevelopment site, Architectural Office, 5 Colham St.—John Thornton and Co, Knowsley Rd, St. Helens, plan £350,000 factory extensions, Eccleston St.

Shotley Bridge. Fennell and Baddiley, Bridge End Chmbrs, Chester-le-Street, architects for additional nursery accommodation at Shotley Bridge Hospital.

Smethwick. Tractor Tracks Ltd, Victoria St, Smethwick 40, plan reconstruction of premises.

Spalding U.D.C. New council offices planned on site of Holyrood, of Church Gate. Surveyor.

Stalybridge. Caroline St works extensions planned for Bostock and Bramley.

Stockton-on-Tees. R. B. Bainbridge, Prudential Bldgs, High St, Stockton, plan two-storey buildings at Garbutt St.—Durham C.C. plans old people's hostel for 38 residents at Redhill Rd, Roseworth.

Stoke-on-Trent. £2,200 improvement scheme for street lighting in Ford Green Rd.

Stretford. A.E.I. (Manchester), Trafford Park, plan two-storey office block, Barton Dock Rd.

Sunderland B.C. Tender: 263 dwellings, Town End Farm estate. Architect, Grange Hse, Stockton Rd.

Business Prospects—Continued

Surrey. S. Griffiths and Ptnrs, 29 Greycoat St, Westminster, S.W.1, quantity surveyors for £400,000 Decca Radar research laboratories.

Teddington. Iris Productions Ltd, Broom Rd, plan £100,000 enlargement of television studios, for research dept and control block. Architects, W. S. Hattrell and Ptnrs, 21 Cleveland Pl, S.W.1.

West Bromwich. C. E. M. Fillmore, 20 Waterloo St, Birmingham 2, architect for

foundry extension, Loveday St, for Newby and Son (Ironfounders).

Willesden B.C. Harold Young and Assoc, 199 Piccadilly, W.1, recommended electrical consultants for erection of new office block.

Wokingham. Wokingham Plastics, Denton Rd, plan new factory at Fishponds Rd.

Wolverton U.D.C. £½ million scheme planned for multi-storey flats. Surveyor.

Wycombe. Austin Hoy and Co. plan engineering assembly department at Station Rd, Saunderton.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Don Electrical Co. Ltd. Meeting of creditors to be held at 93 Queen St, Sheffield 1, on 28 Nov., at 3 p.m.

Phoenix (Electrical Contractors) Ltd. General meeting of members to be held at Tudor Court, 52 Richmond Rd, Worthing, on 13 Dec. at 12 noon, to receive an account of the winding-up.

Tera Electrics Ltd. Winding up order dated 7 Nov.

Shadbolt Bros. Ltd. Last day for receiving proofs for intended dividend 25 Nov., to liquidator: R. A. Rodgers, 25 Bedford Row, W.C.1.

Campbell and Jordan Ltd. Liquidator: F. M. Collins, Inveresk Hse, 346 Strand, W.C.2, released as from 28 Oct.

Thomas Barclay Ltd. Liquidator: F. M. Collins, Inveresk Hse, 346 Strand, W.C.2, released as from 31 Oct.

Elizabethan Eng. Co. Ltd. Creditors to send details to liquidator: H. C. Hedges, 4 Charterhouse Sq, E.C.1, by 7 Dec.

Philpps and Culling (Products) Ltd. Creditors to send details to liquidator: A. Kane, 13 Greenend Rd, Bedford Pk, W.4, by 30 Nov.

Barnard and Buecheler Ltd. Creditors to send details to liquidator: G. E. Simpson, 14 Bryanston St, W.1, by 30 Nov.

J. A. Phillips (Electrical) Ltd. Creditors to send details to liquidator: K. R. Cork, 19 Eastcheap, E.C.3, by 31 Dec.

Ferris Domestic Appliances (Cardiff) Ltd. Winding-up order dated 3 Nov.

Vactric (Mnfg.) Ltd. Mr E. R. Nicholson, 11 Ironmonger La, E.C.2, and Mr A. T. Eaves, 47 Mosley St, Manchester 2, appointed liquidators at extraordinary general meeting on 7 Nov. for purpose of voluntarily winding-up.

Vactric Ltd. Winding-up order dated 14 Nov.

Fenn Electrical Ltd. Meeting of creditors to be held at Kingsley Hotel, Bloomsbury Way, W.C.1, on 28 Nov. at 11 a.m.

BANKRUPTCY ACTS

Receiving Orders

Newport. R. G. Fitzpatrick, retailer of domestic electrical appliances, formerly carrying on business as South Wales Vacuum Services at 7 West Gate Chmbrs, Newport. Receiving order dated 10 Nov.

Norwich. B. G. Firman, electrician, formerly carrying on business as Extol Electrics at 1 Hopewell Terr, Elvington, Yorks. Receiving order dated 10 Nov.

Wigan. D. Hodson, hardware and electrical dealer, carrying on business as Service at 71 Shuttle St, Tyldesley. Receiving order dated 10 Nov.

Croydon. T. Hall, electrical dealer, of 36 Homefield Rd, Old Coulsdon. Receiving order dated 14 Nov.

First Meeting and Public Examinations

Ipswich. A. Middlemiss and B. P. Howe, electrical retailers, formerly carrying on business as Howe and Middlemiss, at 409 String Rd. First meeting: 10.45 a.m., 29 Nov., at Room 1, 3-5 Northgate St, Ipswich; and public examination: 10.30 a.m., 12 Jan., at Shire Hall, St. Helens, Ipswich.

Birmingham. S. L. R. Suckling, plumbing and electrical contractor, formerly carrying on business as Aquatherma, at 2 Chelmsley Grove and formerly in partnership as R. Taylor and Co., at 53 Jamaica Row. Public examination: 10.15 a.m., 7 Dec., at Court Hse, Corpn. St, Birmingham.

Leeds. H. G. Duff, radio, television and electrical dealer, carrying on business at 4 Halliday Grove, Leeds 12, and previously at 7 Canal Rd, Leeds 12, and 8 Dodsworth Court, Leeds 1. Public examination: 10.30 a.m., 17 Jan., at County Court Hse, Albion Pl, Leeds 1.

Appointment of Trustees

Lincoln and Horncastle. N. C. Ravenhill, retailer of drapery, electrical appliances and sewing machines, formerly carrying on busi-

ness at 60 Thrumpton La and 11 Cannon Sq, East Retford, as Ravenhill and Co., and as Lincoln Sewing Machine Co. at 43 Bromwich Rd, Sheffield. Mr C. E. Turton, 91 Talbot St, Nottingham, appointed trustee as from 2 Nov.

Slough. R. G. Daniels, electrical retailer, carrying on business as Hayden Television, at 51-53 Oxford Rd, Windsor. Mr A. H. Milward, 6 Cavendish Pl, 11-15 Wigmore St, W.1, appointed trustee as from 2 Nov.

Bristol. R. A. Gibson and P. L. Long, electrical and plumbing contractors, carrying on business in co-partnership as Gibson and Long at 9 Beech Rd, Horsfield. Mr. G. C. Ehlers, 28 Baldwin St, Bristol 1, appointed trustee as from 7 Nov.

Intended Dividend

Chester. C. P. Wheeldon, electrical and general dealer, formerly carrying on business at Bryn Avel, Brunswick Rd, and 29-39 Mold Rd, Buckley. Last day for receiving proofs 25 Nov., to the trustee: R. P. Booth, 5 Rumford Pl, Chapel St, Liverpool 3.

Dividends

Truro and Falmouth. G. B. Solomon, radio and electrical dealer, carrying on business at 57 Fore St, St. Columb. Dividend per £: 4d, payable at 50 The Terrace, Torquay, on 24 Nov.

Workington and Cockermouth. A. Armstrong, electrical goods factor, lately of 37 Senhouse St, Maryport. Dividend per £: 10½d, payable at 14 Lowther St, Carlisle, on 25 Nov.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Ashburton Precision Components Ltd., 72 Brewery Rd, N.7. Manufacturers of and distributors of precision wirebound resistors and other electrical components, etc. Nom. cap.: £500. Dirs.: Edwd. F. Williams and John C. North.

Braemar Electrical Co. Ltd., Braemar Wks, Braemar Rd, E.13. Nom. cap.: £100. Dirs.: Jack R. W. Day-King, Clifford J. Saunders and Ernest J. Course.

Bullock Bros. (Electrical) Ltd., 41 Brunswick Rd, Gloucester. Nom. cap.: £1,000. Permanent dirs.: Donald F. Bullock and Michael C. Bullock.

K. Butterworth, Valley (Electric) Ltd., Old Smithy, Mytholmroyd, nr. Halifax. Electrical engineers and general electrical installation contractors, etc. Nom. cap.: £1,000. Dirs.: Kenneth Butterworth and Marian Butterworth.

Carruth, Crowther and Caine Ltd., Tyersal Wks, Tyersal La, Bradford. Electrical engineers, etc. Nom. cap.: £3,000. Dirs.: John Carruth, Roy Crowther and Lawrence Cain.

Damastar Ltd., 6 Surrey St, W.C.2. To carry on business of manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Stanley H. Lucas and Francis A. Dean.

Direlec Electrics Ltd., 62 Long Millgate, Manchester. Nom. cap.: £100. Dirs.: Solomon Goldberg and Ben Gee.

Economic Electrics (Barking) Ltd., 45 North St, Barking. To take over business of electricians, electrical engineers and electrical dealers carried on at Barking as "Economic Electrics," etc. Nom. cap.: £100. Dirs.: Reginald A. Hemmings and Cynthia M. Hemmings. Subs.: Havard Y. Rose and Joseph Mandel.

Electrical Kitchen Appliance Rentals Ltd., 141 Stamford Hill, N.16. Nom. cap.: £5,000. Dirs.: to be appointed by subs. Subs.: Hyman Adelman and William D. Spoor.

Electrical Plant and Machinery Co. Ltd., 12 Hilton St, E.1. Nom. cap.: £2,000. Dirs.: Fredk. J. Parsons and James H. Manning.

E.S.M. Eng. Co. Ltd., 36 Lattimore Rd, St. Albans, Herts. Electronic engineers and contractors, etc. Nom. cap.: £100. Dir.: Arthur Gittings.

Felwin Manufacturing Co. Ltd., 126 Wigmore St, W.1. Manufacturers of and dealers in lampshades and lighting fittings, electrical goods, etc. Nom. cap.: £100. Dirs.: Warren Tafel and Martin G. Lewin.

Foden Electrical (Sales) Ltd., 178 Bromsgrove St, Birmingham 5. Dealers in and manufacturers of washing machines, refrigerators, etc. Nom. cap.: £500. Dirs.: Kenneth J. Foden and Mrs Frances D. Foden.

S. W. Fletcher (Contracts) Ltd., Eleanora St, Stoke-on-Trent. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Sam W. Fletcher and Ethel A. Fletcher.

R. G. Jones of Morden Ltd., Morden Park Sound Studios, London Rd, Morden, Surrey. To carry on the business of acoustic, acoustic-electronic, general engineers, etc. Nom. cap.: £100. Dirs.: Ronald G. Jones and Mrs Nora Jones.

Judge Holloware Ltd. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Guy M. Chantry, "Fairacre," Kemble, Glos; and Reginald B. Williams, 12 Ebrington Rd, W. Bromwich.

N.M. Lamps and Shades Ltd., 30 Jermyn St, S.W.1. Nom. cap.: £200. Dirs.: Nita Miller and Jill M. Miller.

Lyon Electric (St. Albans) Ltd., Fiscal Hse, 36 Lattimore Rd, St. Albans. Manufacturers of and dealers in electrical appliances, etc. Nom. cap.: £100. Dirs.: Ronald H. Lyon and Beryl Lyon.

Leslie Hobbs Ltd., 42 Devonshire St, W.1. Manufacturers, importers, exporters, distributor, agents and dealers in electrical goods, etc. Nom. cap.: £1,000. Dir.: Leslie C. Hobbs.

A. D. Purdy Ltd., c/o Thomas Forster and Co., 3 York St, Manchester 2. Electrical engineers and contractors, etc. Nom. cap.: £500. Dirs.: Alan D. Purdy and Stella Purdy.

Rentall Equipment Ltd., 405 Pelham Rd, Immingham, Lincs. To take over business of hirers of electrical equipment carried on as "George Benson" at Immingham, Lincs, etc. Nom. cap.: £2,000. Dirs.: George S. Benson and Elsie M. Benson.

Southern Economic Ltd., Portland Chmbrs, West St, Fareham, Hants. Dealers in domestic and household electrical appliances, etc. Nom. cap.: £1,000. Dirs.: Thos. G. Pope and Fdk. A. Rayner.

MEETINGS TO NOTE

THURSDAY, 24 NOV.

I.E.E. (S. Midlands Education Discussion Circle). "The Study of Non-Linear Circuits at Under-Graduate Level." College of Advanced Technology, Birmingham. 6 p.m.

I.E.E. (Rugby Graduates and Students). "Facts on Sluts." D. C. MacDonald. College of Engineering Technology. 6.30 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Television Recording: A Survey of the Problems and Methods Currently in Use." J. Redmond. Cavendish Laboratory. 8 p.m.

INSTITUTION OF CIVIL ENGINEERS. Discussion: "The Operation of the General Conditions of Contract for Works of Civil Engineering Construction." Gt. George St, S.W.1. 5.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Birmingham). "The Introduction of Planned Maintenance Systems." A. F. Stedman. Grand Hotel. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Maintenance and Operational Experience of a Data Logging Installation." D. C. Austin. Lecture Theatre, Admin. Bldg., The Associated Ethyl Co. Ltd., Oil Sites Rd, Ellesmere Port, Wirral. 7 p.m.

A.S.E.E. (S. London). "Stage Illumination." F. E. Brown. Greyhound Hotel, High St, Croydon. 8 p.m.

I.E.E. (S. Midlands Graduates and Students). Dinner-dance at The Barn, Hockley Heath. 8 p.m.

FRIDAY, 25 NOV.

I.E.E. (N.E. Graduates and Students). "The Direct Generation of Electricity." B. C. Lindley. Grey Hall, King's College, Newcastle. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS, A.G.M. Peppys Hse, 14 Rochester Row, S.W.1. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (Birmingham). "British Railways Electrification Scheme." W. B. Marrian. Imperial Hotel, Temple St. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Scottish). "Instrumentation of a Space Vehicle." Dr A. E. Roy. Glasgow University. 7.15 p.m.

A.S.E.E. (Coventry and District). "A History of Tape Recording." G. Dawson. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy La, Coventry. 7.30 p.m.

MONDAY, 28 NOV.

I.E.E. (Education Circle). Discussion: "Training for Research." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Mersey and N. Wales). "Thermistors—Their Theory, Manufacture and Application." R. W. A. Scarr and R. A. Setterington. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (S. Midlands Electronics and Measurement). "Static Switching." G. L. Butcher. James Watt Memorial Institute, Birmingham. 6 p.m.

I.E.E. (E. Anglia). "An Introduction to Electronic Computers." R. C. M. Barnes. Electric Hse, Ipswich. 6.30 p.m.

I.E.E. (W. Utilization Group). "Discrimination Between h.r.c. Fuses." E. Jacks. S. Western Electricity Board Lecture Theatre Centre, Bristol. 6 p.m.

I.E.E. (N. Staffs). "A Survey of Street Lighting and Its Future." W. R. Stevens and H. M. Ferguson. Mechanical Institute, Crewe. 7 p.m.

I.E.S. (Birmingham). "Production of Light Sources." H. R. Ruff. Regent Hse, St. Phillip's Pl, Colmore Row. 6 p.m.

A.S.E.E. (N.W. London). "Electrical Aspects of Process Control." W. C. Hawkins. Compass Hotel, Watford. 7.45 p.m.

TUESDAY, 29 NOV.

I.E.E. (S.E. Scotland). "Submersible Pumping Plant." H. H. Anderson and W. G. Crawford. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (Irish). Annual dance. Gresham Hotel, Dublin.

INSTITUTION OF CIVIL ENGINEERS. Symposium on "Management." Gt. George St, S.W.1. 5.30 p.m.

IRON AND STEEL INSTITUTE. Hatfield Memorial Lecture. "The Contribution of Metallurgy to Electric Power Generation." L. Rotherham. Hoare Memorial Hall, Church Hse, Gt. Smith St, S.W.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Data Processing Section). Symposium on Nuclear Temperature Scanning. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

CORROSION EXHIBITION at Olympia until 2 Dec.

WEDNESDAY, 30 NOV.

I.E.E. (Electronics and Communications Section). "The Potentialities of Artificial Earth Satellites for Radiocommunication." W. J. Bray. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Eastern). Informal lecture: "Hovercraft." D. J. Hardy; informal lecture: "M1."

F. T. Jones. Neville Hall, Westgate Rd, Newcastle upon Tyne. 7 p.m.

I.E.E. (Sheffield). Discussion: "The Education and Training of a Professional Electrical Engineer." Joint meeting with the Sheffield Graduate and Student Section. Grand Hotel, Sheffield. 6.30 p.m.

I.E.E. (S. Midlands). Joint meeting with Rugby Graduates and Students. "Electricity in Medicine." W. J. Perkins. Rugby College of Technology and Arts, Rugby. 6.30 p.m.

IRON AND STEEL INSTITUTE. Symposium: "Steels for Reactor Pressure Circuits," until 2 Dec. Hoare Memorial Hall, Church Hse, Great Smith St, S.W.1. 9.30 a.m.

INSTITUTION OF MECHANICAL ENGINEERS. "Economic Results of Diesel Electric Motive Power on the Railways in the U.S.A." H. F. Brown. Birdcage Walk, S.W.1. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Wales). "The Application and Selection of Automatic Control Valves." P. Stone. Welsh College of Advanced Technology, Cardiff. 6.45 p.m.

INSTITUTE OF ELECTRICITY ADMINISTRATION. "Publicity and Display." G. Bowen-Jones. Bonnington Hotel, Southampton Row, W.C.2. 6.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (London Graduates). "The Design of the N.P.L. Standard Hardness Test Machines." F. C. P. Mason. Wimbledon Technical College, Gladstone Rd, S.W.19. 7 p.m.

THURSDAY, 1 DEC.

I.E.E. "Our Civic Lighting: Gloom or Galety?" W. R. Stevens and H. M. Ferguson; and "A Survey of Street Lighting and its Future." W. R. Stevens and H. M. Ferguson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Southern). "Instrumentation of Nuclear Reactors." D. Harrison. South Dorset Technical College, Weymouth. 6.30 p.m.

I.E.E. (N. Midlands). "Marine Electrical Practice on Cargo Liners." D. G. Robinson. Joint meeting with Graduate and Student Section. Lecture Theatre, Y.E.B. Offices, Ferensway, Hull. 6.30 p.m.

CHELSFORD ENGINEERING SOCIETY. "The Raising of H.M. Submarine *Truculent*." Lt-Cdr L. Hackman. Hoffmann's Social Hall. 7.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Education Group). "Is Training in Industry Really Integrated with Academic Studies on Sandwich Courses in Colleges of Technology?" Birdcage Walk, S.W.1. 6 p.m.

I.E.S. (Nottingham). "The Eye and Artificial Lighting." W. J. Wellwood Ferguson. Electricity Centre, Carrington St. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N. Western). "Industrial Television." I. M. Waters. Reynolds Hall, College of Technology, Manchester. 7 p.m.

BRITISH INSTITUTE OF MANAGEMENT. Conference: "The Importance of Engineering Services to Modern Management." Connaught Rooms, Gt. Queen St, W.C.2.

A.S.E.E. (Brighton, Hove and District). "Stage Lighting Presentation." F. E. Brown. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

A.S.E.E. (Oxford and District). "Circuit and Equipment Applications of Transistors." Cockcroft Hall, Harwell. 5.45 p.m.

FRIDAY, 2 DEC.

I.E.E. (Medical Electronics Group). Discussion: "Telemetering Biological Data." Savoy Pl, W.C.2. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "Selection Design and Application of Automatic Control Valves." P. Stone. Admin. Bldg, Esso Refinery. 5.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Computer Group). "Progress in Microminiature Circuit Techniques for Digital Computers." D. Roberts, D. S. Campbell and P. M. Thompson. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Midlands). "The Place of the Electric Rocket in Space Propulsion." W. A. S. Murray. North Gloucestershire Technical College, Cheltenham. 7 p.m.

PLASTICS INSTITUTE (N. West). "Hot Runner Moulds." W. G. Lucas. Textile Institute, 10 Blackfriars St, Manchester 3. 6.45 p.m.

A.S.E.E. (Liverpool and District). "An Approach to the Use of Electrical Units." D. Chalmers. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "Variable Speed A.C. Motors." J. C. H. Bone. Royal Hotel, Crewe. 7.30 p.m.

MONDAY, 5 DEC.

I.E.E. Discussion: "National Proving of Domestic Electrical Equipment." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). "The Determination of the Electrical Characteristics of an Arc Furnace." J. Ravencroft. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (S. Midlands). "Parametric Amplifiers." R. V. R. Carter and I. A. Bagnall. Winter Gardens, Gt. Malvern. 7.30 p.m.

I.E.E. (S. Midlands). "Radiocommunication in the Power Industry." E. H. Cox and R. E. Martin. Combined meeting with Electronics and Measurement and the Supply and Utilisation Groups and the Birmingham Centre of the J.P.O.E.E. College of Technology, Birmingham. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics). Lecture: "Radar Observations of Birds and 'Angels'." E. Eastwood. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (Maidstone). "Uses and Manufacture of M.I.C.C. Cable." G. E. D. Redman. Maidstone Technical College. 7 p.m.

N.E. ELECTRICAL CLUB. "Looking at Lighting." A. Wilcock. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Yorkshire). "Instrumentation for Railway Research." P. H. Mansfield. University, St. George's Sheffield 1. 7 p.m.

I.E.S. (Leeds). Members' Night. Lighting installations by members of the Centre. British Lighting Council, 24 Aire St. 6.15 p.m.

I.E.S. (Newcastle). "Looking at Lighting." Wilcock. County Hotel. 6.30 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

AF in diamond design. B792,283. Class 9. Apparatus, etc. Société de l'Accumulateur Fulmen, 14-20 Quai de Clichy, Clichy (Seine), France.

Anoware Rinse-n-Dry. 798,625. Class 7. Centrifugal rinsing and drying machines. Ellvin and Co. Ltd., 17 Willow La, Mitcham.

Auto-Chef. B800,221. Class 9. Control apparatus for automatically maintaining predetermined temperatures in cooking appliances. British Thermostat Co. Ltd., Teddington Wks, Windmill Rd, Sunbury-on-Thames.

Bailey Meters. 777,631 and Bailey. 782,871. Class 9. Apparatus, etc. Bailey Meters and Controls Ltd., Purley Way, Croydon.

CTS in design. 799,498. Class 9. Resistors, potentiometers, etc. CTS Corp., 1142-1228 W. Beardsley Ave, Elkhart, Indiana, U.S.A.

Drytime. 799,084. Class 7. Tumbler drying machines. 799,085. Class 11. Drying cabinets, etc. Wallisdown Electrical Appliances Ltd., Wallisdown Rd, Winton, Bournemouth.

Keymatic. 799,408. Class 7. Domestic machines, motors, etc. Hoover Ltd., Perivale Greenford, Middx.

Minilog. B801,316. Class 9. Panels incorporating components, etc. Panellit Ltd., Dudden Hill La, N.W.10.

Moodmaster. 805,138. Class 9. Sound recording and reproducing apparatus, etc. Wavemex Ltd., 14 Essex St, W.C.2.

Ozajet. 797,073. Class 9. Apparatus, etc. Ozalid Co. Ltd., 62 London Wall, E.C.2.

Solak. 807,340. Class 11. Fans, etc. Solartron Electronic Group Ltd., Solartron Wks, Queen's Rd, Thames Ditton.

Swirlator. 802,722. Class 7. Machines for washing, drying, etc. General Steel War Ltd., 199 River St, Toronto, Canada.

Ven-o-Set. 806,259. Class 9. Apparatus, etc. Venner Ltd., Kingston By-pass, New Malden, Surrey.

Wescriber. 807,255. Class 9. Railway signalling apparatus, etc. Westinghouse Brake and Signal Co. Ltd., 82 York Way, N.1.

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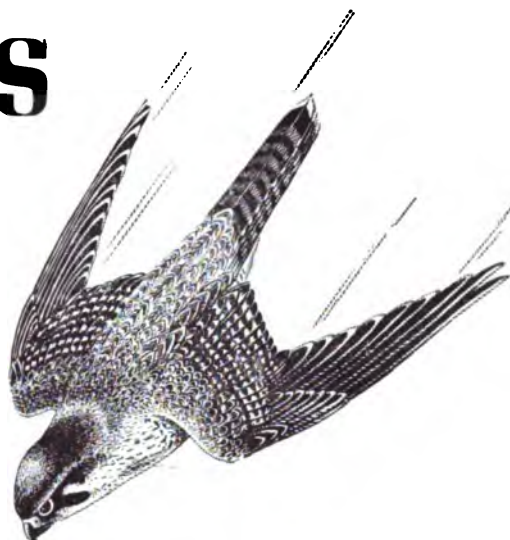
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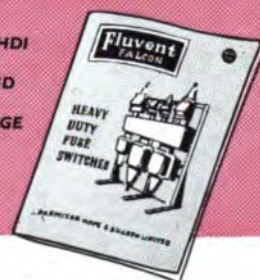
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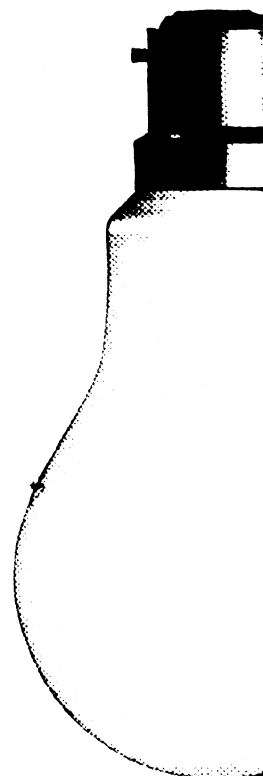
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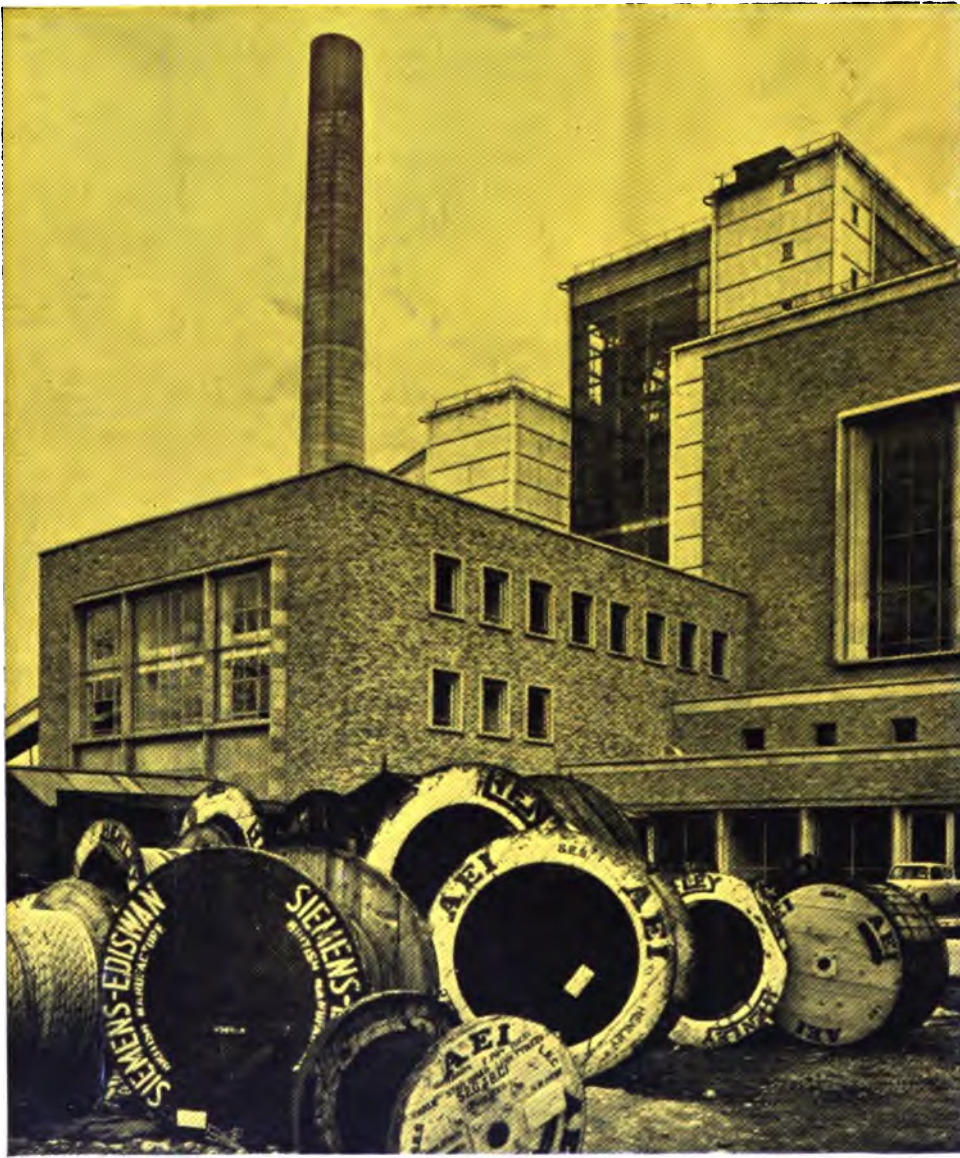
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pour Câbles Solides en Aluminium ... 831
développement progressif des câbles d'aluminium à couches isolées au p.v.c. comprenant des conducteurs aluminium solides de phase, en forme de secteur, ayant une gaine concentrique neutre de fils aluminium plats. Une couche protectrice de p.v.c. a servi à résoudre divers problèmes de conception, de fabrication et d'installation. Au point de vue conception, la construction est comparée aux tentatives antérieures d'emploi de conducteurs solides dans les câbles, offre des avantages de conception supérieure, un poids plus léger et une quantité de produit isolateur. Pour la mise en pose dans des sols saturés d'eaux corrosives, la protection est assurée par l'application de bandes imprégnées d'un chromate.

Provenant du Barrage d'Assouan ... 835
Le principal du barrage d'Assouan sur le Nil est l'énergie. Les problèmes qui se posent à cause du besoin de réduire la chute hydraulique à des intensités faibles afin de réduire les crues annuelles ont, jusqu'à présent, obstrué la production d'énergie. Le développement des turbines Kaplan et une concession octroyée par le gouvernement ont maintenant contribué à la réalisation d'un projet de 350 MW. Neuf groupes électrogènes dont six opèrent déjà, fournissent l'énergie à la région d'Assouan au moyen de lignes aériennes de 132 kV, aux consommateurs d'électricité.

Impact du Sol sur le Rendement des Câbles ... 838
Leurs installations de câbles pourraient avoir leur rendement augmenté si les propriétés locales thermiques étaient connues avec plus d'exactitude. Les modifications relativement infimes de la résistivité thermique du sol peuvent résulter en des économies du coût. Les ingénieurs britanniques, au nom de CIGRE, sont à recueillir des enseignements au moyen d'un questionnaire. (Les réponses d'outre-mer seront accueillies avec plaisir.)

Dieser Nummer

Aluminium-Vollleiterkabel-Ausführung ... 831
Die Probleme im Zusammenhang mit der Konstruktion und Verlegung von Kabeln sind durch stetige Entwicklung PVC-isolierter, vieladriger Aluminiumkabel gelöst worden, die Aluminium-Vollleiterkabel mit runder Querschnitt, eine konzentrische, als tragende Armierung aus Aluminium-Flachdrähten mit einem PVC-Mantel aufweisen. Vom Konstruktionsstandpunkt bietet die bevorzugte Ausführungsform solcher Kabel im Gegensatz zu früheren, volladrigen Versuchskabeln folgende wesentlichen Vorteile: geringen Raumbedarf, leichtes Gewicht und Isolierstoffeinsparung. Bei gleicher Verlegung in mit korrodierender Bodenfeuchtigkeit getränkter Erde, empfiehlt es sich, das Kabel mit Bariumchromatimprägniertem Band zu überziehen.

Stromerzeugung durch das Assuan-Stauwerk ... 835
Der Zweck des Assuan-Stauwerks am Nil ist die Bewässerung. Der Umstand aber, wonach zwecks der Überschwemmungsregulierung für eine starke Senkung der Stauhöhe Sorge getragen werden mußte, bildete bis vor Kurzem ein Hindernis gegen die Realisierung des Stauwerks für die Kraftstromerzeugung. Durch den im Kaplanturbinenbau und eine Konzession der staatlichen Wasserbehörde ermöglichten jedoch die Realisierung eines auf 350 MW ausgelegten Kraftwerks, das neun Generatorsätze umfaßt, von denen sechs im Betrieb stehen. Das neue Kraftwerk wird die Assuan mit Kraftstrom versorgen und ausserdem in 132 KV-Freileitungssystem Verbrauchern in anderen Teilen des Landes beliefern.

Einfluss der Bodenbeschaffenheit auf Kabelnennungen ... 838
Bei vielen Kabelanlagen könnten die zulässigen Beanspruchungswerte hinaufgesetzt werden wenn die örtlichen Eigenschaften des Bodens mit grösserer Genauigkeit bekannt wären. Verhältnismässig geringe Schwankungen des spezifischen Widerstandes können sich weitgehend auf die Kosten der Anlage auswirken. Die Techniker, im Namen CIGRE, trachten mit Hilfe eines Fragebogens weitere Informationen zu dieser Frage zu erhalten und hoffen auch Antworten aus Übersee zu erhalten.

Solid Aluminium Cables—Part 1	831
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- M.E.M. H.R.C. cartridge fuse-links are available for use with this range of switchgear, and have been A.S.T.A. certified for Category of Duty 440 AC3 (16,500 amps), 440 AC4 (33,000 amps) and 440 AC5 (46,000 amps).
- "Exel" switches comply with the relevant Temperature Rise, and making and breaking Capacity Tests of B.S.861: Part 1, 1955, and switchfuses with B.S.2510:1954.



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ELECTRICAL TIMES

ESTABLISHED 1891

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ment

PATTERN OF TRADE

The announcement by the GEC that they are cutting prices of two types of major appliance received considerable attention in the daily Press, and if this seemed more than warranted it must be attributed to the excellent presentation of the case. Of the two price reductions concerned, that of cookers is one that causes surprise. Cookers are in the van of appliance sales and the latest figures show production running at some 17% above last year. This, then, is not a cut of desperation but one of commercial acumen, the sort of act that is possible only when tooling costs have been written off and one is looking for a larger share of the market. A significant factor is the extension of reductions to the low-priced estate model, which will now sell at £26; it is this cut that is the more likely to stimulate competition from other manufacturers. The reduction in refrigerator prices, on the other hand, is for wholly different reasons. The upward surge in demand last year attracted too many sources of supply; as a result the pipe-line has become blocked with half a million refrigerators which must be disposed of before any sort of balanced trading can be restored. The GEC has not been the first firm to slash refrigerator prices; it will not be the last. Although the potential refrigerator market is as large as ever, it is the one that has shown up in sharpest relief the influence of Government controls in unbalancing trading conditions. In contrast, those appliances that are not influenced by hire-purchase trading are still showing steady stable growth. Fortunately, the electrical industry has not been faced with the severity of the hire-purchase radio or motor markets, nor is it likely to be. It is these that are building up a pressure for revision of hire-purchase restrictions, from which domestic appliances would also benefit. In present economic circumstances it is reasonable to anticipate that the Government may be forced to some amelioration of present restrictions early in the new year.

LARGEST NUCLEAR YET

With a net electrical rating of 580 MW based on two reactors, the Sizewell nuclear power station is the largest ordered in the British series. This seventh station is also notable for the remarkable advance in size secured in the turbo-alternators, which are to be of 325 MW capacity despite the relatively modest h.p. steam conditions adopted, 646 lb/sq in., 700°F. Clearly, important design advances have been secured, of which the preliminary details give only an indication through a mention of "the longest exhaust blades yet manufactured," and of use of bled steam to keep down moisture content at the l.p. end. In respect of steam conditions

and in some other characteristics, Sizewell, in comparison with its predecessor, Dungeness, in the second round of CEBG nuclear station contracts, illustrates the wide choice facing designers in securing the best solution in terms of effective cost per kWh over full station life. Despite its advanced features, it seems that Sizewell will have an output capacity 2% lower than Dungeness in terms of MW output per ton of uranium invested, and because of the more modest steam conditions will produce about 7% less electrical energy for every pound of uranium burnt up. Yet the manufacturers are confidently claiming that they will generate electricity "cheapest in the world so far from a nuclear power station." The £55 million value placed on the Sizewell contract suggests a capital cost, excluding fuel, of £95/kW. The implied saving on earlier designs must come from economy in details, in the cost of individual plant items and in construction techniques. In this respect, a notable feature will be the combination of the two reactors in a single building, thus changing at last the essential outline of the British nuclear station design as set by Calder Hall and retained in all succeeding stations.

MAKING THE MOST OF CABLES

It is a fundamental in the design of a cable installation that the rating allocated to a particular cable depends on the ambient conditions. When a directly embedded cable is concerned, rating depends on the thermal effectiveness of the soil. The more heat the soil can conduct away for a given cable surface temperature, the higher the permissible current loading of the cable. This problem of the mains engineer's "g" is made complicated because soil is a chancy thing, varying widely in its thermal resistivity without any easily predictable pattern. The industry has, on the whole, taken the easy way out in the past and adopted a value of "g" that is unlikely to lead to cable overheating. But this involves a factor of safety that may be highly expensive where cables for transmission voltages are concerned, and there has been growing attention to measuring "g" along the cable route, so that a realistic rating may be given. Measuring so variable a quantity, however, may be a lengthy process and it is inevitably still somewhat indefinite in the end result of cable rating. The industry is currently attempting to find some means of judging soils in a way that will permit a more realistic value of "g" to be assigned, without the need for anything more complex than classification of soils on a basis of sight and touch, and subsequent consultation of prepared tables. To evolve such a technique is clearly a matter for co-operative work, and it is along these lines that the task is being tackled. This week we include a questionnaire aimed at surveying existing practice more widely. The engineers directing the co-operative effort will be greatly helped by replies from as wide a field as possible. Replies will be used to produce data of

value to all cable users, so there is incentive for all to help themselves by completing the form.

WIRING FOR OFFICES

An article this week tells of a solution developed in New Zealand to the problem of wiring offices where movable partitions are used. It brings a reminder of how universal is the problem of adapting electrical installation techniques to fit in with fast-developing building practice. Coping with rooms that change their size and shape is now a familiar problem, although there is no universal acceptance of any one method of dealing with it; but there are other difficulties that arise less commonly, and often with insufficient warning to give the electrical engineer a chance of determining a fully satisfactory answer, such as use of structural techniques which do not permit the usual making of holes to accommodate electrical fixings. On the electrical side, there are the special demands of floor-warming systems, which can greatly complicate the use of floor ducting systems for power and telephone distribution. When these difficulties arise, something becomes obvious that is usually submerged: that there is too little contact in early planning between architect, constructional engineer and electrical installation planner.

SOLID CABLES

To many engineers the idea of a cable with solid conductors seems improbable at first consideration. In the development of solid-sector aluminium cables, this has none the less been achieved without limitations of flexibility that might be expected. A series of articles that begins in our pages this week outlines the present status of design, manufacturing and installation technique of this type of cable, which received its first notice in our pages 18 months ago. Once the limitation to circuits where a concentric neutral without external earthed sheath is accepted, a number of advantages appear. One of the more striking is the economy in dielectric achieved in the design directly through use of solid conductors instead of stranded cores. Another follows almost incidentally from the method of construction adopted; it is a highly promising performance under through short-circuit currents. This characteristic is gaining in importance in cable evaluation, through the need to give full scope to economic switching possibilities. Finally, the design adopted is notable for the attention that has been given to making it a practical manufacturing possibility in terms of existing cable-making machinery. The design claims are high here, and appear to have good support. If users come to like the cable—and its relative ease of jointing may recommend it to them, quite apart from price considerations—then it is probable that their accustomed suppliers will be able to make the cable with relatively little difficulty.

Meteo

Solid aluminium cables

PART 1. DESIGN CONSIDERATIONS

LITTLE over 18 months ago—on 4 June, 1959, to be exact—these pages disclosed the first information to be released on a new development in distribution technology, solid-core, plastic-insulated, aluminium, later to be known as "Solidal." At the time it was clear that the new construction was only just out of the development stage and, indeed, the related jointing techniques were still being investigated. Since then a number of British and European cable companies have begun manufacture of "Solidal" cables and several variations have been laid down. The transition from experiment to production has taken place and much valuable information on processing has been acquired. The cables in service, some of which have now been carrying current for a twelvemonth, are behaving satisfactorily, though it is as yet too early to draw conclusions as to their useful life. Jointing techniques have been perfected, tested and found to be satisfactory and practicable. The means of bringing experience to date before other engineers and users of "Solidal" cables, Alcan S.A. of which are shortly releasing a handbook* on the subject which will first appear in English and later in other European languages. It will cover basic design, manufacturing techniques and installation practices from the first days, when the preliminary investigations were undertaken on a line suggested by Mr S. F. Rice, Electrical Manager of Alcan S.A.

Arrangements have been made for extracts from the handbook to be made available for readers of the ELECTRICAL TIMES and three have been prepared. This, the first, deals with basic design considerations. Manufacturing and installation techniques are to be dealt with individually in the remaining extracts, which will appear at a later date.

Early Work

One of the first steps taken was to examine possible markets for such a cable. Extensive surveys soon established that by far the largest tonnage of conductor material was absorbed by low voltage cables such as are used for urban distribution and factory installations. It was therefore, decided to concentrate initial efforts in research and development towards this particular field.

The main requirements which would have to be satisfied were as follows:

A current-carrying range of 100 A to 400 A.
Voltage between phases up to 1.1 kV. It was felt that the costs of insulation would not materially be reduced in cases for working voltages below that level and both manufacturers and users would profit by standardisation of voltage ratings.

A single class of cable equally suitable for direct burial, insertion in ducts, indoor mounting or overhead primary suspension; that is, one design of cable for all types of service.



Fig. 1. To test the resistance of "Solidal" cables to corrosive soils when the outer sheath was abraded or damaged an extensive programme of experiments was carried out. Here a group of cables are being prepared for such a period-test with current passing through them

4. Simultaneous compliance, as far as applicable, with international standards and, in particular, the following:

Britain:	Draft revision of BS 2004 and BS 2746
France:	NF C 32-202 (1956) and NF C 32-200 (1954)
Germany:	VDE 0271/5-58
Netherlands:	KEMA Nr. K-30 (1959)
Switzerland:	SEV 1004 (1959)
Italy:	CEI 20-4 (1953)
International:	CEE Nr. 13 (1955)

5. Low production cost. Special equipment or complex processes to be avoided. Production to be kept, as far as possible, within the capacity of any manufacturer of bare overhead aluminium conductors with equipment for plastic extrusion.

6. Simple jointing methods suitable for live working.

7. Inherently safe in use, including risk from mechanical damage when on load.

8. General standards of quality and reliability equal to or above that for other cables on the market for comparable duty.

The result of the study within these parameters led to the adoption of a basic design comprising three cores of solid aluminium, sector-shaped, insulated with p.v.c. and laid up together, the whole being wrapped with transparent p.v.c. tapes to form the bedding of the fourth conductor, a neutral comprising a concentric layer of flat armour

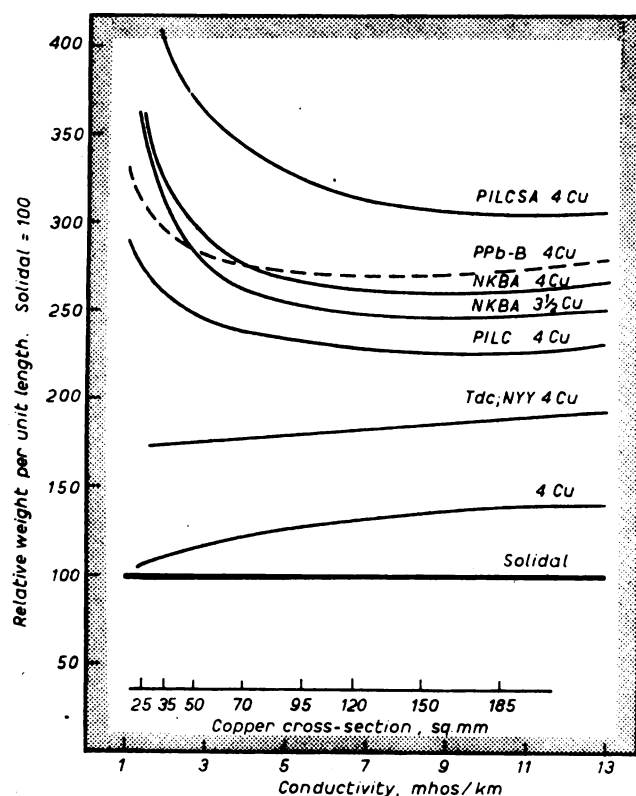


Fig. 2. Comparison of weight of conventional-type cables with "Solidal." "Solidal" = 100. The line, 4 Cu, represents the weight of four bare copper conductors

wires. The outer oversheath of the completed cable to be of extruded p.v.c.

In comparison with conventional stranded conductor cables, "Solidal" cables to this design are strikingly light and compact. Fig. 2 gives a comparison of its weight with that of equivalent size conventional cables. The same cable is suitable for both three-phase/neutral distribution and for three-phase balanced load systems. In the latter, the concentric conductor acts as a protective armour and earth continuity path.

This basic design, distilled from every conceivable configuration and combination of materials, is to some extent a compromise but one which is believed to be not far below the optimum. Modifications could be made in a number of directions but only at the expense of other properties.



Fig. 4. A solid sector "Edison Tube" installed in Milan in 1882 (Edison-Volta, Milan)

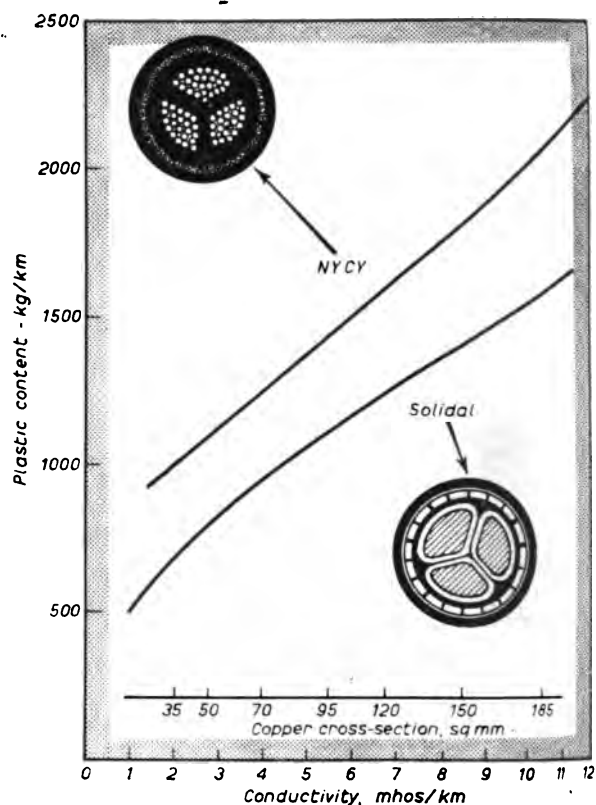


Fig. 3. The relative weights of p.v.c. required in the manufacture of "Solidal" cable and stranded copper cable of equal conductivity and similar configuration

Not all cable-makers are equipped to produce tubular aluminium sheaths. Therefore, to comply with the condition that the design should avoid fabrication processes for which abundant facilities did not exist, the balance of favour fell towards the choice of plastic insulation without an external tubular metal sheath.

The armour wires, of flat cross-section, were designed for ease in drawing to shape and size in the type of wire drawing machine with which many aluminium fabricators are equipped, the number of wires being adjusted so that they could be applied in an ordinary overhead cable stranding machine using the 18-bobbin cage only.

Configuration

Initial development and design work was confined to the 3-core, concentric neutral cable. Investigation among distribution engineers in many parts of the world indicated that, where protective multiple earthing was not already officially in use, it existed *de facto* or its introduction was being studied. It appeared that a concentric neutral/armour conductor would be sufficiently acceptable for general use by the time development had reached completion. Viewed in retrospect, this seems to be substantially true.

There are, of course, many other configurations which may be adopted. Single, twin and 4-core cables have been designed, having either steel or aluminium armour. A particularly interesting arrangement is one which has since been developed by Unidare Ltd. of Dublin for industrial wiring. This comprises one neutral and three phase conductors in a modified sector form with a fifth earth conductor at the geometrical centre, an elegant solution in terms of economising in the use of p.v.c. insulation (Fig. 6).

A number of different series of cable sizes exist throughout the world. These include British sizes expressed in cross-sectional area, American sizes

mils and equivalent a.w.g. and many metric based on varied nominal sectional areas. There common sizes.

of Sizes

each cable size in copper there are two possible nts; one based on resistance—or voltage drop—: other on current-carrying capacity for a given ture rise above ambient. Which basis to choose? is demonstrably more rational than the other or rely to be acceptable generally. In the engineering e best solution is one which provides a limited of sizes in well-regulated steps and the decision de to base this in steps of nominal current rating e most common ambient conditions. On this basis er of cables was made up and tested in a suitable f sizes.

hosen ratings do not, of course, preclude the pro- of "Solidal" cables in any size to meet national ls or individual customer's requirements. In the as been decided to design the cables on the basis of es and sectional areas specified in BS 2791:1956. ltiplication of sizes without economic justification ever, hardly in common interest; standardisation e best interest of both buyer and cable-maker.

Solid Conductor

is nothing new in the use of solid sector cable ors. The first insulated cables ever to be made seem had solid copper conductors. Fig. 4 shows one of iest examples installed in Milan by Edison-Volta and history records similar cables being installed on a year earlier.

g the second world war, paper-insulated cables lid sector aluminium conductors were made on a scale when copper was in short supply, but were ed due, it is believed, to difficulties with the nsulation. In recent years, small sizes of street cable closely resembling "Solidal" have been in Berlin (West) and when the first announcements d in these pages it was revealed that British d Callender's Cables had produced four-core nsulated cables with solid aluminium cores entally a few months earlier (Fig. 5).

uminium conductor is larger in net area than the nt copper conductor and the first problem was to the overall dimensions of the aluminium-cored far as possible. With aluminium a solid conductor t can be made of pure annealed metal with a ivity of over 62% I.A.C.S. as compared with 61% wn wires. The best commercial compacted wire or is rarely as much as 95% solid, so there is a dvantage to be gained by the use of a solid or.

Fully annealed aluminium has an ultimate tensile strength of only 7 kg/sq mm. (4.5 tons/sq in.) as compared with 25 kg/sq mm. for annealed copper; the modulus of elasticity is about 50% of that of copper. Solid aluminium conductors will yield at a load of less than one-third of that required for an equivalent annealed copper conductor.

The shape of solid sector conductors can be closely controlled; a shaped stranded conductor cannot to the same extent. The conductors of "Solidal" cables can,



Fig. 5. Experimental 4-core, solid sector, aluminium cables with p.v.c. insulation and steel wire armour (BICC Ltd.)



Fig. 6. A solid multicore aluminium cable design with central neutral for industrial wiring (Unidare Ltd.)

cable end of "Solidal" stripped back to show construction

ree shaped aluminium solid sector tors.

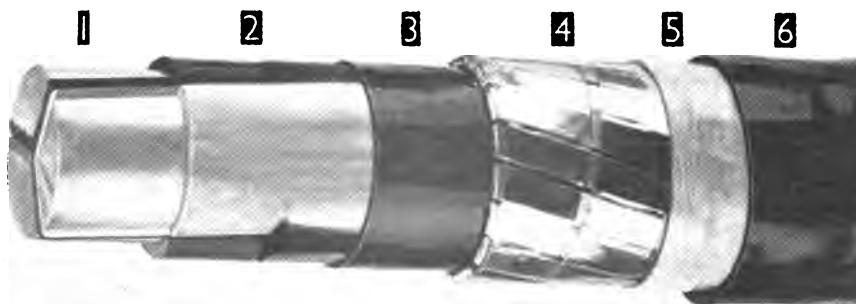
conductor insulation coloured for dentification.

ex" tape and p.v.c. bedding for the conductor.

icentric neutral conductor comprising inium wires, spiral wound. These rve as armouring. A current equali- uminium tape is also applied around ductor.

chromate impregnated tape for on inhibition.

rsheath of p.v.c. compound.



therefore, be nested very closely, saving fillers and keeping both size and plastic content to a minimum. This is, perhaps, the most important advantage of the solid conductor in sector form, enabling a high space factor to be achieved in the cable.

The smooth surfaces of the solid conductor, by preventing the insulation from adhering, promote flexibility in handling. The insulation is subjected to pressure but never to shear, a factor which favours the use of harder grades of p.v.c. since it compensates for their lower elongation.

Solid conductors can be made more cheaply than stranded ones and there are several methods for their production. They can be formed by rolling and drawing or by extrusion, and pre-spiralling before insulating is unnecessary. A solid conductor is easy to joint, particularly for service connections.

Insulation

In the past, paper has been the predominant insulant for the types of power cables that "Solidal" can replace. Although cheaper as a material than its rivals, it requires a moisture-proof metal sheath and jointing techniques demand relatively high skill. Plastic insulation is superior in these two respects and is rapidly gaining acceptance as an insulation for cables of this type. P.V.C. was selected for all initial tests, though other plastics—and, indeed, paper—are being tried.

With plastic, thickness of insulation is more a question of mechanical than electrical import. No real attempt has been made to assess how thin the insulation can be on a "Solidal" cable but, instead, the thicknesses in various national specifications have been adopted instead.

Bedding

The correct construction of the bedding over the laid-up cores is important since it serves several functions. From discussions with cable-makers and users it was elicited that short-circuit currents of the order of 100 times normal full-load current over a period of up to 10 cycles may be expected. In conventional paper-insulated cables the bedding and sheath acts as a container for the very large mechanical forces set up between conductors under heavy current fault conditions.

In "Solidal" cables, the insulated conductors lay up naturally to form a solid mass and the bursting force on the aluminium section is borne by large areas of insulation in compression against a tightly applied "Melinex" tape. This is followed by p.v.c. tapes, also tightly applied, and this adds to the resistance against disruptive mechanical forces on short-circuit in addition to providing a firm basis for the flat neutral/armour wires. Clear or translucent tapes are specified to enable identifying core colours to be recognised before the sheath is removed, a valuable feature in distribution cables on which service connections have to be made.

Neutral Armouring

Flat wires are used to make hard bedding possible, reduce the bulk of the cable and also the number and cost of the wires. Round wires would have had to be smaller, require softer bedding and, in addition, would have necessitated special armouring machines. From the costing point, a small number of large wires is cheaper to apply than a large number of small wires added to which is the fact that the aluminium wire industry is already equipped to produce large-size wires in quantity for bare overhead cables. There is not, at present, the same demand for fine aluminium armouring wires.

The choice of a neutral cross-section equivalent to that of a core conductor was governed by the consideration that many distribution authorities use a full section core for the neutral and, in any case, reducing the neutral section by 50% would affect the cost of the cable by no more than 5%.

In the interests of rationalisation, the same size of wire was adopted for 150 A and 200 A cables and a second size for 250 A and 300 A cables. This meant an increase in neutral area over core area in two sizes of cable, but it simplifies manufacture and reduces the range of associated fittings. The lay length of the armouring is limited to ensure flexibility and to increase circumferential strength.

Current Equalising Tape

Where a concentric stranded conductor is used as a neutral or earthed armouring it is important that, in the event of a fault, the resistance of the earth path should be a minimum. The whole of the conductor must be effective with each strand carrying an equal share of the current. In "Solidal" cable the individual strands are connected laterally to each other by a spiral aluminium tape wound over the neutral conductor.

Barium Chromate Tape

Another aspect of design which has been given careful consideration is the effect of burying the cable in grounds saturated with corrosive soil waters (Fig. 1). In the ordinary way, full protection is given by the p.v.c. oversheath, which is not attacked by, and is impervious to, such contaminants, but there is always the latent possibility that the oversheath may become perforated or scuffed by mechanical damage, allowing the fluids to enter. A secondary defence barrier was, therefore, provided in the form of a textile tape impregnated with a class of chemical known as "corrosion inhibitors." Of the many available, the chromates of certain metals are most generally useful for aluminium and, of these, barium and zinc chromate have the additional feature of "leaching out" only very slowly over extended periods. Further experiment, reinforced by experience with transatlantic telephone cable incorporating aluminium strip screen under a polythene outer sheath, turned the balance of favour towards barium chromate and this has been adopted as the impregnant for the barrier tape when specified for direct burial in water-bearing soils.

Outer Sheath

An outer black p.v.c. sheath, applied over the neutral conductor and/or chromate tape, of thickness to meet the most severe specifications in regular use, completes the cable. The choice of black for the oversheath is influenced by the consideration that the cable may be used as an overhead line, where it will be subject to prolonged exposure to sunlight. Experience has shown that black p.v.c. of the proper compounding exhibits the best resistance to such conditions.

As a final point, clear and permanent marking of the cable and cores is prescribed in the specification. It is important that the workman who is preparing to joint a length of "Solidal" cable shall be aware that the first layer of armour may be carrying current. The oversheath must, therefore, bear the words "neutral concentric," while the colour of the inner conductor insulation provides ready identification of the respective phases.

In the next article we shall deal with the problem of installing and jointing "Solidal" cables.

Power from the Aswan dam

350 MW PROJECT DESCRIBED AT JOINT I.E.E./I.C.E. MEETING

THE Aswan Dam lies across the River Nile some 600 miles from the delta. Built in 1902, to the design of Sir Benjamin Baker, to store water from the flood against the dry season for irrigation purposes, it has been heightened on two occasions. The original dam, 81 ft high, provided a storage capacity of 1,000 million cubic metres (1 mld cu m). In 1910-11, the crest was raised 18 ft, increasing storage by a further 1.5 mld cu m, and again in 1933-34 to 125 ft to provide a final storage capacity of 5.6 mld cu m. The present level, however, allows for storage of only 5 mld cu m, which compares with a total annual flow through the river system of around 100 mld cu m.

The available head and storage capacity of the system automatically invited consideration of hydro-electric power generation as a subsidiary function. Although this was discussed as early as 1932, there were certain aspects which complicated the issue. During the period from May to 1-July each year the reservoir water level is lowered progressively by raising the discharge rates so as to be ready to accept the flood waters from the upper reaches, usually arriving at the dam area in late July. At the lowest point the effective head is only 10 ft. This annual variation in head, ranging from 108 ft down to 10 ft, makes efficient design and operation virtually impossible. Seasonal lowering of the reservoir level is responsible for the fall in effective head, not rising levels below the level as presumed on page 794 of last week's issue.)

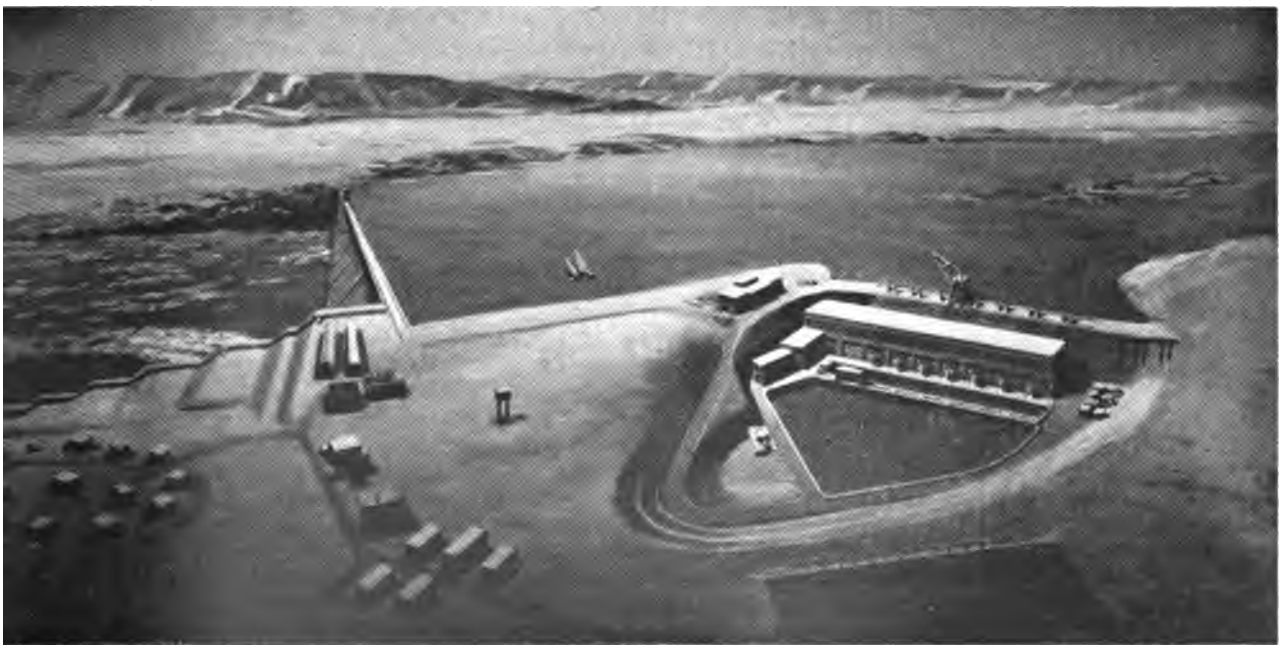
Paper 6463: "The Aswan Hydro-Electric Scheme," Institution of Civil Engineers.

In 1945, the Egyptian Government set up a Hydro-Electric Power Commission, under the Presidency of Dr Abdel Aziz Ahmed, which examined all the proposals and finally authorised the construction of the 350 MW station and headworks, which were commissioned early this year. Consultants to the scheme were Kennedy and Donkin, of London, and Vattenbyggnadsbyran, of Stockholm. Mr G. F. Kennedy and Mr V. Furuskog, partners of these two firms, described the project* before a joint meeting of the ICE and the IEE in London last week.

The Civil Work

The civil engineering works comprised a head-race, intake dam, surge basin, four tunnels conveying the water downstream of the dam and a tail-race, together with the power-house, turbine foundations, transformer and switch-gear platforms, etc. These were constructed to the west on the bank adjacent to the dam, the tunnels and tail-race extending some 2,500 yd downstream past Soheil lock. The four tunnels from the basin actually pass under the navigation canal below the lock before discharging into the lower Nile reaches.

The intake dam, nearly 1,000 ft long at the crest and 118 ft high at the main part, is of granite rubble masonry with a watertight concrete front and is founded on granite. A concrete apron, extending 18 ft upstream, gives access to the turbine intakes, each of which is provided with screens, bulkhead gates and intake gates. A 150-ton crane on the dam serves the intake gates and roller carriages.



View of the model showing the power station with, in the background, the Aswan dam

Behind the dam lies the turbine-house, a concrete structure containing eight 77 ft long bays, each housing one main unit or two house units. Sloping penstocks couple the turbine casings to the intake openings, the steel spiral casings being embedded in concrete. Draft tubes on the main units are 65 ft wide and extend 65 ft downstream before discharging into the open surge basin. Four D-shaped tunnels, each of which is 1,600 sq ft cross-section and range from 2,450 ft to 2,960 ft in length, convey tail water from the basin to the downstream tail-race.

The turbine-house is of reinforced concrete, based on a system of vertical columns, panel walls and crane beams, with a steel lattice roof and thermal insulation covering. The area is divided into nine bays, each housing one main set or two house sets and each bay, with its superstructure, is a self-contained unit having no rigid connection with adjacent bays. A shelf on the downstream side provides accommodation for the main transformers and is connected to the downstream open structure supporting the draft tube gates and raising gear by a transporter bridge. Administrative offices and control rooms are adjacent to the power-house, with the outdoor 132 kV switching station on a platform on the opposite side of the surge basin.

Turbines

Contracts for the turbines were divided between Swiss and Swedish firms. The turbines are all of the Kaplan type, the main units being designed to develop an output of 65,000 h.p. at 88 ft to 100 ft head, falling to 6,500 h.p. at 20 ft. The irrigation authorities agreed, in 1945, to raise the minimum flood season level to 26 ft and this, together with an extra head achieved by excavations at Soheil lock downstream of the tunnel outlets, gives a minimum effective head of about 32 ft. At this head, machines 3 and 4 develop 17,400 h.p. and the remainder 19,500 h.p. Turbines for the house units are rated at 17,150 h.p. at 110 ft, falling to 3,210 h.p. at 32 ft. The speed of the main sets is 100 r.p.m. and that of the house sets, 250 r.p.m.

Generators

The main generators are of conventional salient pole design with tangentially mounted air ducts for closed-circuit cooling. They are rated at 49,500 kVA, 0.95 p.f., 11 kV, 50 c/s. The house sets are rated at 13,550 kVA, 0.85 p.f., 11 kV, 50 c/s. All units are equipped with air-operated braking pads and hand jacking pumps. Generators 1 to 7, of Swiss manufacture, have two guide bearings and an overhead thrust bearing. Generators 8 and 9, of Swedish design, incorporate combined thrust and guide bearings below the rotor, though not in umbrella type of construction.

Electrical Engineering Contractors	
Turbines—1, 2 ...	Charmilles (Geneva), Switzerland.
3, 4 ...	Escher Wyss (Zurich), Switzerland.
5-9 ...	KMW (Karlstad), Germany.
Alternators—1, 2 ...	Secheron (Geneva), Switzerland.
3, 4 ...	Oerlikon (Zurich), Switzerland.
5-7 ...	Brown Boveri (Baden), Switzerland.
8, 9 ...	ASEA (Vasteras), Sweden.
Transformers ...	ASEA (Vasteras), Sweden.
132 kV Switchgear ...	ASEA (Vasteras), Sweden.
11, 3.3 kV and 400 V Switchgear ...	Reyrolle (Hebburn), England.
Overhead lines ...	Societa Anonima Elettificazione (Milan), Italy.
Cranes—Station ...	Societe des Forges et Ateliers du Creusot, France.
Erection ...	Ansaldo (Genoa), Italy.
Lock ...	Shehada Engineering (Cairo), Egypt.
Intake ...	Wagner-Biro AG (Vienna), Austria.
Consultants:	
Kennedy & Donkin, London, England.	
Vattenbyggnadsbyran (VBB), Stockholm, Sweden.	

Transformers

Each of the main units is solidly connected to the primarily windings of 51 MVA, 11/132 kV transformers by short, bare copper connections. The 132 kV windings are, in turn, connected by overhead cable to the 132 kV switching station. In addition, sets No. 3 and No. 6 are connected through switches to the 11 kV house busbars in parallel with the output of the 11,500 MW house sets. Two 3 MVA 11/3.3 kV transformers couple the 11 kV and 3.3 kV busbars where they link with the diesel station, and the 400 V supplies for auxiliaries are provided from busbars coupled to the 3.3 kV bus through four 400 kVA transformers and, for station services, through two 800 kVA transformers.

Outgoing supplies to Aswan town are provided from the 11 kV bus and to the fertiliser factory, the pumping station at Sudd-el-Ali and the High Dam site at Edfu and Komobo by 132 kV overhead lines.

Fire protection is provided by a water emulsification plant for the transformers and by CO₂ for the generators.

Commissioning

Orders for the generators and turbines were placed in 1947 and the civil engineering contracts were signed in May, 1953, the site of the station having been altered in the meantime. The dam was completed in 1958 and the first of the main units commissioned at the official opening in December, 1959. Today, the house sets and six of the main units are in service and the remainder are in an advanced state of erection.

After reading a summary of the papers, in which Mr Kennedy paid tribute to the co-operation between the 37 countries and seven nationalities engaged on the project with English as the common language, the authors presented an excellent sound and colour film of the project from the earliest stages to the official opening.

Discussion

In the subsequent discussion, Mr MacDonald, son of Sir Murdoch MacDonald, whose name is linked with the two stages of development of the Aswan Dam and much of the earlier history of hydro-electric survey, mentioned that the first time hydro-electric generation was mooted was in 1902, when it was proposed for an electric railway between Aswan and Luxor. The first fertiliser project was raised in 1910 after a visit to Norway. Mr Herbert Addison said that he was glad Mr Kennedy had referred to the happy co-operation between the many nationals and, indeed, this international spirit between engineers was something of which all could be proud.

Mr James Walker commented on the design of the main generators. The large capacity of the station crane was presumably for lifting out the whole rotor for maintenance. Recent designs of generators, larger in capacity than Aswan, with the rotor and stator split in section enables cranes of only 75 tons to be used. The high short circuit ratio also seemed excessive and must have added to the cost. D.C. exciters, too, might be giving place to the a.c. exciter with semiconductor rectifiers in future. He also commented on the effects of dust from braking pads and suggested that dynamic braking would solve the problem. As a final point, he proposed the use of inhibiting insulation for stator windings. The vapour emitted at high temperatures were as efficient as CO₂ extinguishing fires, with less risk of inadvertent operation. Mr O'Sullivan spoke on siltation problems and the author briefly replied.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Lighting in Iron and Steel Works

YOU recently printed an article called "Lighting in Iron and Steel Works" based on a paper which was presented to the Iron and Steel Institute. As I had not had the opportunity of commenting on this before publication, I should be pleased if you would make it clear to your readers that all the opinions expressed in this article are my own. I would refer especially to the section titled "Lighting intensity."

I do not agree—nor I am sure do many manufacturers—lost industrial fittings—that dust deposition on the surfaces of lamps is "inescapable." Nor do I think that one can generalise and say that it is uneconomical to wait for lamps to burn out before replacing them. There are so many aspects to consider which affect lamp replacement policy and not the least of these is the fact that a lamp burning out is only very infrequently in an iron and steel plant that a lamp burning out will interfere with production.

Further, I do not believe that good lighting pays "high dividends" if by high dividends is meant increased profit alone, but that it is a service and as such it need only be justified on its own merits.

Finally, I had hoped that one of the themes of my article was that whilst it is comparatively easy for light engineers to evolve maintenance schedules and records which would ensure that lighting is kept at a high standard of performance (and I agree that these things are important), in these days of labour shortages, increased production, expanding plants, new techniques, etc., it is quite so easy for the plant electrical engineer to neglect these systems. After all, his real job is to make the plant run, and what is often forgotten, profit.

D. R. M. Nisbet, A.M.I.E.E.,
CHIEF ELECTRICAL ENGINEER,
APPLEBY-FRODINGHAM STEEL CO.,
SCUNTHORPE, Lincs.

Isolators and Switches

MR OXLEY (ELECTRICAL TIMES, 20 November) has illustrated the confusion that exists between isolators and switches. The distinction is referred to in the new word of BS 3078:1959 as follows:

"Particular attention is drawn to the distinction now made between an 'isolator' and a 'switch.' An isolator has no making or breaking capacity and if the position of the device in the system necessitates a making or breaking capacity for safe operation, a switch or circuit-breaker should be used."

A switch, on the other hand, should be capable of making and breaking load current and for some categories of fault-making on to a fault.

Where oil-immersed switchgear is concerned the three types, i.e., the isolator, oil switch and oil circuit-breaker, covered by British Standards 3078, 2631 and 116 (or 117) respectively. For air-break switchgear the coverage of British Standards is not complete, but the distinction between the air-break isolator, air-break switch and the oil circuit-breaker should be maintained.

The use of the term "isolating switch" is peculiar to the control gear industry and its use is to be deprecated elsewhere. It may be presumed that an "isolator"

fitted with a load breaking device is capable also of making load current and hence it should be classed as a switch.

C. D. Woodward,
PRESS AND PUBLIC RELATIONS OFFICER,
BRITISH STANDARDS INSTITUTION,
LONDON W.1.

Heating Oil

IN your issue of 10 November, F. J. Halligley, writing about expanding ball and roller bearings by heating them in an oil bath, states: "I was horrified to observe a drum of light machine oil being heated by a blow lamp," and then describes "contriving an electrically and thermostatically controlled oil tank, the heating element being of the type intended for domestic hot water tanks."

I, too, am horrified at the use of a heater designed for water heating being used for oil heating, unless it is not loaded at the normal maximum water heating rating, for oil heater loading is generally at least 50% of that for water heating to prevent carbonisation, whilst many oils when heated become corrosive and attack the element sheathing.

A.M.I.E.E.,
YORKSHIRE.

Earthing and Safety

MEGOHM is right when he says (ELECTRICAL TIMES, 3 November) that "many arguments and discussions could be based on the pros and cons of the earthed and non-earthed systems." Unfortunately this must always remain a matter of opinion, incapable of statistical determination, because, whilst we can amass statistics of the number of instances where broken earth connections have been responsible for fatalities, we shall never know the number of lives which have been saved because the metal cases of apparatus have not been earthed in the "earth-free" situation which, according to the thirteenth edition of the IEE Regulations, no longer exists.

E. H. Jesty, A.M.I.E.E.,
BROMLEY, KENT.

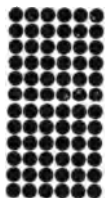
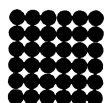
[Since we received this letter, we have learned with sorrow that Mr Jesty has died.—Ed.]

13 Amp Plugs

YOUR contributor Megohm has once again performed a service in raising the intractable problem of matching the correct size fuse contained in 13 A plugs to the load of the appliance. The use of appropriate information on the fuse dispenser card by a certain manufacturer is all to the good. Other makers are also to be commended on their efforts, such as warning tags.

Since so many interested bodies are working towards a solution, perhaps the British Standards Institution, who are after all responsible for BS 1362, covering 13 A plugs, could also play a part. I would suggest a revision of BS 1362 which will ensure that the base of the plug contains the words in bold indelible red lettering: *Important for Safety Insert the Correct Size Fuse.*

M. Neidle, GRADUATE I.E.E.,
EDGWARE.



Cable ratings depend on soil thermal resistivity

SCOPE FOR SAVINGS ON INSTALLATIONS

RECOGNITION of the significant influence of soil thermal resistivity upon the size of cable needed to meet known loading requirements, and, therefore, upon the cost of cable installations, has emphasised the importance of developing better methods of assessment of soil thermal resistivity. This recognition is slowly but surely gaining ground amongst supply engineers.

At the present time it is customary to assume one value of soil thermal resistivity, "g," regardless of location, and to design a cable installation on that basis. The value generally used in Great Britain is 120°C cm/W , although ERA Report F/T 183¹ includes current rating tables based on two assumed values of soil thermal resistivity, 90°C and 120°C cm/W . In other countries different values are used; for instance in Germany a value of 70°C cm/W and in France 85°C cm/W . The wide variation in practice between different countries is a clear indication of the need for using values of soil resistivity based on actual measurements instead of on empirical figures.

Soil Investigations

Most of the investigation work on soil thermal resistivity has so far been carried out in Great Britain and America and the present position has been publicised recently in two papers, one British² and one American.³ These papers were presented in 1960 practically simultaneously, one in Paris during the CIGRE and the other in Atlantic City at the AIEE Summer Convention.

In Great Britain, the main investigations have been into the natural soil conditions and to assess thermal resistivities assuming re-use of the soil actually excavated and disregarding any special soil which may be used immediately around the cable for protective purposes. In America, on the other hand, an important part of their investigations has been to discover types of soil which can be used to replace the excavated soil in order to give lower overall soil thermal resistivities. Otherwise, it is interesting to find from study of the papers that the investigations, while carried out independently, have reached similar tentative conclusions and agree broadly on the basis for future work.

The CIGRE paper 214³ reviews the present position and shows that much more basic in-

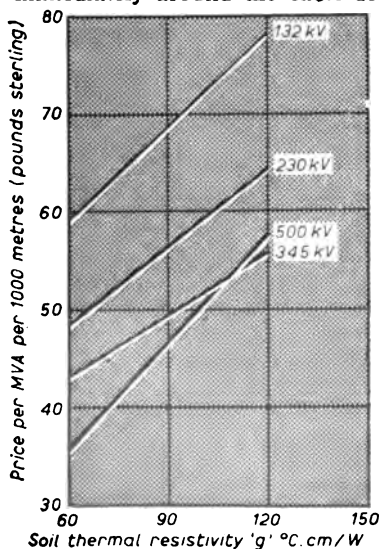
formation is needed. The techniques of soil thermal resistivity measurement with a needle probe under controlled conditions have been developed to an acceptable standard and can be completed reasonably quickly in the field. Similarly, a satisfactory method for the measurement of soil moisture content has been developed.

The effect of moisture on soil thermal resistivity is widely recognised, but information is available for only a few soils. The extent to which one may expect moisture content to vary with season or environment is not sufficiently well known and is confined to a few types of soil in certain localities. Finally, the effect of cable heating on the moisture content of different types of soil has only recently received detailed attention.

CABLE QUESTIONNAIRE SEEKS SOIL THERMAL DATA

Through the questionnaire opposite, a group of British engineers seek co-operation from supply engineers and organisations at home and overseas in collecting data on soil thermal characteristics. Full use of these properties can yield substantial capital savings on h.v. cable schemes. Data will enable charts to be prepared to assist engineers in the design of more economical installations in the future.

Please send the completed form with any additional comments to: The Secretary, CIGRE British National Committee (Paper 214-1960), Thorneycroft Manor, Dorking Rd, Leatherhead, Surrey, England.



Graph showing variation of price with "g" for oil-filled cables. Prices include materials and installation and are based on continuous loading conditions

Classification of soils has until recently been carried out by civil engineers using, for example, the Casagrande system.⁴ This system is used by engineers interested in the mechanical properties of the soil. Such classifications are rather too detailed to be of use to cable engineers who are primarily concerned with thermal characteristics. However, a simplified method of classifying soils into groups has recently been devised for the benefit of cable engineers by ERA and it is described in their Report F/T 198.⁵ So far, this classification is based upon physical properties and is a first step towards grouping and classification by thermal properties.

Cable engineers who wish to secure maximum economy by basing cable sizes on actual measurements made with soil from prospective routes will thus find that at the present time they have not available sufficient basic data for a proper engineering assessment and that the following additional information is needed:

(a) Much more general information on the variations of thermal resistivity for the different types of soil with different moisture contents.

(b) Much more general information on the variations of the moisture content of different soils due to seasonal changes, or to moisture movement as a result of the heat dissipation from a loaded cable.

(c) A classification of soils into groups based on their thermal characteristics only.

(d) A method of identifying a soil into one of the above groups by subjective examination, e.g., sight and touch.

Future Research

A programme of research in Great Britain has accordingly been suggested, leading up to the preparation of what might be called a "Soil characteristics chart" for the use of cable engineers.

It has been proposed that tests be carried out in the laboratory to establish curves showing the moisture content/soil thermal resistivity characteristics over a wide range of soils and soil mixtures between limits of dry density.

It is proposed that these curves should then be sent to a panel of cable engineers to be classified by them into groups so arranged that all the soils in any group could be treated by them as identical for the purpose of assessing "g." This important task would, incidentally, indicate the limits of error within which cable engineers are prepared to work when assessing the value of "g."

Soil research engineers would then have to devise a scheme for classifying soils in these new groups by subjective examination.

As and when such a research is completed, placing a soil into a group by examination on site would enable the cable engineer to select the curve showing its characteristics. The general pattern of this curve, together with the value of "g" and the moisture content value received from site tests, would enable the cable engineer to prepare curves for the soils with which he is dealing.

When more information on (a), (b), (c), (d) above is available an engineering approach to the assessment of soil thermal resistivity will be possible from basic data

modified to take account of local soil conditions, the heating effect of the cable and seasonal variations.

Co-operation will Accelerate Progress

An organised effort is being made in Britain towards amassing information required to produce the "Soil characteristics chart," but progress in this respect would be expedited if the results of independent surveys could be collected and analysed.

Therefore, information given in answer to questions on the detachable sheet would be of great value to the authors of CIGRE Paper 214², who have also prepared this article.

The importance of obtaining agreement on methods of assessment internationally is widely accepted, and the above-mentioned questionnaire is also being submitted to an international committee for consideration.

With a view to covering as wide a field as possible, it would be appreciated if supply engineers and others interested would be good enough to detach and complete the questionnaire and send it with any further information or comments to the address stated.

REFERENCES

1. ERA Report Ref. F/T 183: "Current Ratings of Paper and Varnished Cambric Insulated Cables to British Standards, 1955."
2. CIGRE Paper 214—1960: "Soil Thermal Resistivity. A Practical Approach to its Assessment and its Influence on the Current Rating of Buried Cables," by R. S. Orchard, Merz and McLellan; C. C. Barnes, CEBG; P. M. Hollingsworth, BICC; and K. Mochlinski, ERA.
3. AIEE Trans., Paper 60-785: "Soil Thermal Characteristics in Relation to Underground Power Cables."
4. Casagrande, A.: "Classification and Identification of Soils." Proc. Amer. Soc. Civ. Eng., 1947.
5. ERA Report Ref. F/T 198: Soil Classification for Cable Engineers."

Aerodrome lighting guide

REVISED B.S. TAKES ACCOUNT OF AVIATION DEVELOPMENTS

THE importance of standardisation for airfield lighting throughout the world can hardly be overstressed. It is with this precept in mind that the British Standards Institution has prepared their revised edition of the "Guide to Civil Land Aerodrome Lighting" (BS 1332: 1960).

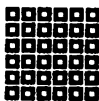
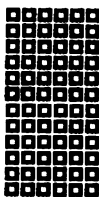
The guide was first published in 1932. The revised form is based on Annex 14 (third edition 1958) of the International Civil Aviation Organisation (ICAO). The ICAO is constantly endeavouring to standardise systems of aerodrome lighting used throughout the world, particularly their lighting patterns and colour coding, although it is, of course, unavoidable that for operational reasons the scale of lighting necessary varies from one airport to another. However, in addition to the Calvert system used in this country, Annex 14 recognises the ALPA system and also certain methods of emphasising the runway threshold. These have not been adopted in British practice.

The guide relates to aerodromes for fixed wing aircraft since, as yet, there is no international standard giving recommendations for helicopter stations. However, it is hoped to include these at a later date. The guide is in 12 sections covering definitions, general requirements and the various forms of beacons, approach, taxiing and obstruction lighting. Reference is made to types of circling,

guidance and runway lighting which are still undergoing development and operational evaluation, but which have recently been included in Annex 14. They include the two-colour angle of approach indicator developed at RAE Farnborough, which is now being installed at several civil airports in this country. This system has also been subjected to flight trials in America and has now been adopted by the Federal Aviation Agency.

Another important aspect of airfield lighting is the provision of improved indication of runway surface to meet the increased approach speeds of modern aircraft. Greater intensity of approach and runway edge lighting has been necessary to meet this need and also to improve bad weather approach techniques. The first scheme to meet this requirement consisted of runway surface lights over the length of the touch down zone and was installed first at Gatwick and later at Prestwick. Further experience has shown that, particularly for take off in low visibility, it is also an advantage to have additional lights defining the centre line of the runway.

The higher speeds of modern aircraft has meant an increase in their circuit pattern, so making it more difficult for a pilot to position his aircraft in correct relation to the runway. A system of high intensity lights facing outwards along the runway or approach can meet this requirement.



Sizewell contract placed

SUFFOLK NUCLEAR STATION RATED AT 580 MW

SIZEWELL nuclear power station, seventh to be built in Great Britain, is to be designed and constructed by the English Electric—Babcock and Wilcox—Taylor Woodrow Atomic Power Group. Last week the CEBG indicated its intention of placing a contract with this group for a station with a net electrical output of 580 MW, to be built on a site on the Suffolk coast north of Aldeburgh. The two reactors of the gas-cooled, graphite-moderated natural uranium reactor are due to be commissioned in 1965 and 1966, respectively, and the contractors estimate that building will begin next April. Value of the contract is £55 million.

Design Details

Preliminary design details of the station indicate notable advances on previous techniques. That most apparent from the external appearance of the station will be use of a single reactor building to contain both reactors, with a single-pile cap area served by 250-ton main cranes. A turbine-house for two 325 MW turbo-alternators will be arranged parallel to the reactor-house, both being at right angles to the sea. In construction of the station, use will be made of the Goliath crane currently engaged in erection of Hinkley Point. The crane will be dismantled and re-erected at Sizewell; 275 kV switchgear will be housed in a building to the west of the station.

The table on page 841 gives leading technical details of the Sizewell design. Each of the reactors is contained by a spherical pressure vessel 4 in.-plus thick, with the graphite core supported on an orthogonal lattice of Warren girders. The 11 ft 9 in. roof over the reactor pressure vessels extends over the area between the reactors. Control, service plant and fuel store rooms will be placed between the reactors. A supplementary biological shield is to be placed around the main shield to mask the major openings for coolant gas and air ducts. Common working of the pile cap area will permit use of a single central fuel discharge system, with only one compact cooling pond.

Higher heat ratings are claimed for the fuel elements as compared with previous designs put forward by the group. The Magnox fuel cans will have multiple-start helical fins giving a polyzonal surface. Seven fuel elements are to be stacked in each fuel channel. Fuel loading and unloading will both be carried out from the pile cap.

Reactor operation will be through an automatic control system which effects major changes in heat output by changing coolant gas mass flow. For this purpose a change will be made in the setting of circular inlet guide vanes on the main circulators, with additional use of a gas by-pass system. Reactor outlet gas temperature will be kept steady by adjusting control rods in the reactor, and compensation for effects of xenon formation obtained by permitting the inlet gas temperature to increase.

Nuclear Design Advance

WITH an output rating of 580 MW, Sizewell is the largest nuclear station so far planned. Announcement of the design details provides a convenient occasion for looking at the progress that has been made since the first trio of contracts were placed for nuclear power stations. Those contracts covered Bradwell (300 MW), Berkeley (275 MW) and Hunterston (320 MW), and were placed in December 1956. Next came Hinkley Point (500 MW) in September 1957, to be followed by Trawsfynydd (500 MW) in June, 1959. Last July the Dungeness contract was awarded for a 550 MW station.

Much of the advance in size has come through attention to engineering details rather than through any major advance in technology. Indeed, in glancing through outline technical details for successive stations, it is notable how little some figures have changed. For example, the diameter of the uranium fuel rod has remained almost constant at 1.1 in., and there has been little alteration in the temperature at which the bulk of the

CO₂ leaves the reactor pressure vessel. In consequence, there have been only slight changes in the temperature of the steam fed to the turbines; the range is from 322°C (615°F) at Berkeley, to 392°C (740°F) at Dungeness. Nor has the mass of uranium in each reactor changed as much as might be expected. For Bradwell one load is 273 metric tons, Berkeley 253 and Hunterston 251. Hinkley jumped to 368 tons, but Dungeness secures its output from only 298 tons, and Sizewell from 321 tons.

What has changed markedly is the gas pressure permissible, through increase in thickness of pressure vessel which can be fabricated on site. The early stations used in general 3 in. plate for the pressure vessels, with an increase to 3½ in. with Trawsfynydd, and to 4 in. for Dungeness and now Sizewell. This increase has been used to permit higher gas pressures; not to increase the size of the spherical pressure vessel. Indeed, Dungeness and Sizewell at about 63 ft internal diameter are smaller than Hinkley Point and its predecessors.

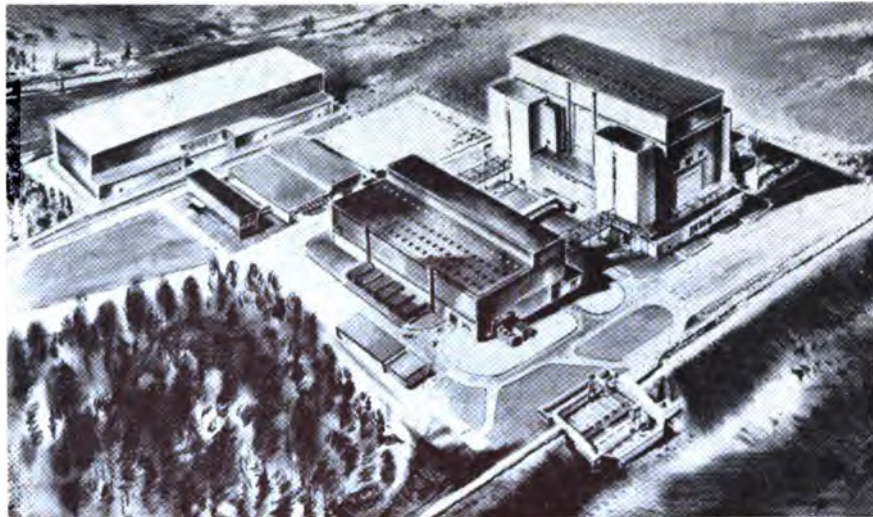
Gas pressure has climbed sharply, however. For the first stations it was 126 lb/sq in. (Berkeley), 132 (Bradwell), and 150 (Hunterston). Hinkley Point saw an increase to 185 lb/sq in., and Trawsfynydd to 240 lb/sq in. For Dungeness the figure is 283 lb/sq in., closely approached at Sizewell where it is 279 lb/sq in.

Such higher gas pressures mean that higher pressures are possible in the steam cycle associated with the nuclear reactor, and also more mass flow of gas for given power put into the blowers. Whereas the steam pressure at Berkeley is as low as 306 lb/sq in. for the h.p. turbines, at Dungeness it is 1,410 lb/sq in. Sizewell makes a step backwards in this respect, presumably indicating particular confidence in design of the low pressure sections of the turbine shed.

Mastery over steam conditions has brought steady increase in alternator size, with the well-known advantages that follow. The first three stations range from 52 MW to 85 MW. Hinkley Point uses 93.5 MW sets, Trawsfynydd 145 MW. There is not much change for Dungeness (143 MW), but the jump for Sizewell is significant.



te of the station in relation to
owns. Heavy plant will be brought
estoft, then 26 miles by road to
rtist's impression of the station



to be one single-stage axial gas blower for
e eight boilers (the name the group is using
steam-raising unit or heat exchanger). Constant-
induction motor drives have been selected,
rs fed through transformers connected to the
ators.

will be arranged in pairs on opposite sides of
building. They will use low-alloy, high-tensile
h is claimed to have advantages in terms of
ght and thickness. Boiler tube elements are
horizontal banks. Through advances in tech-
a boiler will produce over half as much steam
counterpart at Hinkley Point with a shell only
ger.

ressure steam cycle is to be used, with a side-
rheater arrangement that gives maximum l.p.
erheat. The number of penetrations into the
be reduced by using trifurcations to connect
three elements.

by-pass already mentioned is to be included
boiler shell. Entry of gas into the by-pass
ll be controlled through a valve system actuated
de the shell through a displaced bellows positive
Blower, control valve and by-pass system will
ommodated in the bottom of the boiler shell,
ties for the whole unit to be withdrawn for
ce. Boilers are to be shielded.

On

only two turbo-alternators, each of 325 MW,
ly reduces the size of turbine-house required.
ines will have in-line tandem arrangement with
cylinder and multi-double-flow l.p. cylinders.
is made that the l.p. cylinders will have the
haust blades yet manufactured. Turbines will
ed pressure design to meet the needs of the
actor operation, and a novel feature will be
d steam to reduce exhaust wetness.
top valve temperatures and pressures are given
le. Corresponding turbine figures are 646 lb/sq
700°F h.p. and 253 lb/sq in. gauge, 700°F l.p.
f the three-phase, 50 c/s alternators is rated
VA for 0.85 p.f. lagging. Generation will be at
with water-cooled hollow stator conductors and
i. hydrogen cooling for the stators.
ed to each alternator will be a 340 MVA
V transformer with 275 kV cables to the switch
, where there will be connection with the super-
switchgear is the subject of a separate contract.

Cooling water will be obtained through an intake
structure 1,800 ft offshore, connected through twin 10 ft
diameter tunnels to the turbine-house. Further tunnels will
take the discharged water 500 ft out to sea.

Technical Details of Sizewell Power Station

Station	
Net electrical output	580 MW
Net thermal efficiency	30.5 %
Reactors	
Number of reactors	2
Reactor heat rating	950 MW
Pressure vessel diameter	63 ft 6 in
Pressure vessel thickness	over 4 in
Coolant	CO ₂
Reactor inlet pressure	279 lb/sq in. abs.
Fuel	Natural uranium
Fuel rod diameter	1.1 in
Fuel charge/reactor	321 tonnes
Mean fuel heat rating	2.95 MW (heat)/
Number of elements per channel	7 tonnes
Boilers and Turbines	
Number of boilers	8
H.P. drum pressure	720 lb/sq in. abs.
H.P. superheater outlet temperature	391°C
L.P. drum pressure	305 lb/sq in. abs.
L.P. superheater outlet temperature	390°C
Steam pressure at h.p. boiler stop valve	677 lb/sq in. gauge
Steam temperature at h.p. boiler stop valve	389°C
Steam pressure at l.p. boiler stop valve	268 lb/sq in. gauge
Steam temp. at l.p. boiler stop valve	389°C
Vacuum	29 in. Hg
H.P. steam flow from each boiler	540 klb/hr
L.P. steam flow from each boiler	190 klb/hr
Boiler dimensions	91 ft 6 in. by 22 ft 6 in.
Number of main turbines	2
Output of each turbine	324.75 MW
Main Circulators	
Number of circulators	8
Type of circulators	Vertical, single stage axial, with variable stagger inlet guide vanes.
Drive	Vertical squirrel- cage induction type motor.
Civil Engineering Data	
Height of reactor building	193 ft
Length of reactor building	400 ft approx.
Mean thickness of concrete main shield	5 ft 6 in.
Mean thickness of concrete supplementary shield	5 ft
Thickness of pile cap	11 ft 9 in.
Turbine hall overall dimensions	Approx. 385 ft x 155 ft wide x 94 ft high

NOTES ON WIRING

BY M E G O H M

WE are gradually getting used to meeting new words in these modern days and one which seems to be coming into use in many fields is "silicone." We find that the furniture polish used in the home contains this useful component and we are assured that it is only necessary to use the polish every six weeks. We meet silicone products in the electrical field also and one instance of its use is in the manufacture of cables which will stand up to very high temperatures, 200°C, and yet remain flexible in a temperature of -70°C. They are claimed to resist weathering, ozone and oxidation, low-pressure steam, water and many chemicals. In high temperatures they resist electrical fatigue and corona discharge. It is even said that they will continue to operate efficiently even if subjected to extreme heat in an outbreak of fire.

We already know the claims for m.i.c.c. cables in hot spots, and it would appear that much is being done by various manufacturers to assist the electrical industry to overcome, and even defeat, the usual cry when a fire occurs that the electrical wiring was the cause. We have progressed rapidly in the last few years in protective apparatus as well as cables and possible fire danger can largely be eliminated on an installation. There are, of course, many other factors which come into play, including the human element. There is also cost to be considered, and I regret to note that the electrical installation is still the first section of a building to come under the financial axe when economy is called for. Time and time again this happens, and unless the work is kept under strict supervision many things can take place which could, and often does, lead to trouble. There are still contractors who skimp the installation when such situations arise.

Boiler-houses

Keeping to "hot spots" as it were, I was in the company of some contracting friends discussing the various trends of thought regarding wiring in boiler-houses. I think the conversation started through the mention of carrying out work for different county councils, and the different ideas in the various specifications. The majority of municipal engineers appear to agree that m.i.c.c. cables are the ideal thing for boiler-houses but that is as far as it goes. Certain of them allow the m.i.c.c. cable to be taken right into thermostats, motorised valves, etc., providing the conductor tails are sleeved with silicone or other similar sleeving. Others insist on the m.i.c.c. cable terminating about 18 in. from the apparatus and continuing to the terminals in asbestos flexible or similar heat-resisting cable. I, personally, have found that it is quite practical to take the m.i.c.c. cable right into such units, leaving a small single, or double, loop of cable at the position which will allow easy disconnection in the event of trouble.

Another matter raised was that one local authority required the m.i.c.c. cable, when installed in coke-fired boiler-houses, to be painted with bitumastic paint. I would have thought that a p.v.c. serving would suffice in such situations, for I have used this in much more corrosive atmospheres with satisfactory results. Of course, engineers do have their own ideas and if they are in a position of authority then these ideas become more or less law. It has

to be admitted, however, that many of these ideas are based on practical experience.

The discussion went on, away from local authorities, to general matters and in particular the neutral bar and its connections. I was impressed by the number of these engineers who consider that it should be standard practice for fuseboards to have a neutral bar with one connection per fuseway so that the neutral can be easily removed when that particular circuit is being tested. I quite agree with this suggestion and whenever possible I try to install fuseboards with such facilities. Many manufacturers do not provide such requirements, yet the extra cost involved in doing so must be negligible.

Other manufacturers go further than providing one neutral connection per fuseway and offer a hinged neutral link, which means that there is no need to disconnect the cable at all. I have seen these fuseboards installed in large stores, technical schools and factories and the resident electricians were full of praise for them. Regular testing of circuits connected to these fuseboards is simplified.

Smokeless Zones Again

Some weeks ago I mentioned the smokeless zone (or smoke control area, more correctly) in connection with the question of installing switch sockets. At that time, although I did not say so in these columns, the matter of the possible purchase of smokeless fuel was gone into before the decision was reached to use electricity. I have no experience of such fuel, but I do know that the Clean Air Act calls for fire without smoke even at the lighting stage. This presents a problem in itself, and it is interesting to note that the new electric firelighter has appeared to assist in the matter. The unit has a fan which blows air over a 1,800 kW element. Safety measures include a master key for switching the unit on, while the outer case is kept cool by passing a jet of cold air between the outer case and the inner element case.

New Products

I received details of some new products this week the prototypes of which were on view at the last Electrical Engineers' Exhibition and are now available. One is a three-gang plateswitch which is the same size as the single-gang plate and this should prove extremely useful in housing work. The plate has 2½ in. fixing centres and the accessory is suitable for plaster-depth boxes. The switches themselves are two-way type but can be wired as one-way. They are available in brown or ivory and are styled to match the other accessories of this now well-known range. Also available are the moulded flanged boxes for recessing into skirtings without the need to cut a precise hole. These are fixed into place at the corners.

The third item is a range of plaster-depth and deep boxes and clamps for use with m.i.c.c. cable. The clamps are separate and can be fixed to the boxes as required by means of screws and shakeproof washers. The clamps are, I might add, of the type which clamps both the cable and the pot. I shall say no more at the moment for I understand there is some controversy about the best method of bonding m.i.c.c. cable at box terminations.

Generation by free piston engines

FUTURE COMBINATION WITH STEAM CYCLE LIKELY

ITY generation by gas turbine-driven rs operating in conjunction with free piston ng increasingly used. The scheme is outlined presented last Friday to the Manchester f Engineers.*

articular application the free piston engine gasifier, supplying heated and pressurised gas turbine which in turn, drives the The free piston engine has several valuable bly its freedom from vibration and light also relatively easily and quickly maintained n with a diesel engine.

engines manufactured by The National Gas e Co. are in use for electrical generation in anging from a single, 600 kW unit to a power cing 36 MW. This station has 48 gasifiers 6 MW gas turbo-alternators. These gasifiers 1,250 gas h.p. and although larger units are ration by several makers, so far as is known yet out of the development stage.

of Gasifier

ing principle of the free piston gasifier is Fig. 1. The engine is started by admitting ir to the pressure cylinders 9, so forcing the gether and compressing a mixture of air and l in the engine cylinder, 1. The pistons, 2 are ned by a light linkage to ensure that they on, but this linkage transmits none of the ut power. An important advantage of the e absence of connecting rods and crankshafts. ce, there are no major out-of-balance forces cause vibration.

mitted through the injector, 3, and ignition ith the scavenge and exhaust ports, 7 and 8, pistons are driven outwards compressing air 1 space 9 preparatory to their return for the As the pistons move outwards, air is drawn mpression cylinders, 4, through the suction ortionly before outer dead centre, the exhaust uncovered and the gases pass to the gas Subsequently, the scavenge port 7 is un-compressed air from the engine case : cylinder, and mixes with the combustion a gas-air mixture in the gas collector at 850°F for driving the turbine C. Air come cushion space, 9, brings the pistons to rest dead centres and then returns them to e next cycle.

ston gasifier had both upper and lower limits low it can deliver. The upper limit is set by 1 stroke which can be tolerated, while the determined by the minimum stroke to avoid g caused by partial uncovering of the ports.

Piston Engine," by W. Lowe, B.Sc., A.M.I.MECH.E., we is chief development engineer, The National ngine Co. Ltd.

If therefore, the turbine is to operate on low load there must be provision for by-passing that portion of the gasifier minimum delivery not required by the turbine.

This could be accomplished by a blow-off valve, but a better way, if the engine is to idle for long periods, is to return part of the scavenged air from the engine case to the engine compressor intake. This technique reduces no-load fuel consumption from 175 to 30 lb/hr and mass flow to about 15% of that at full load.

Free piston gasifiers operating in conjunction with gas turbines deliver about 1,000 h.p. at the turbine shaft for a gas h.p. of 1,250. Up to ten gasifiers may supply each turbine through a common gas collector. The gas collector also serves to damp severe variations of gas pressure at the turbine stop valve.

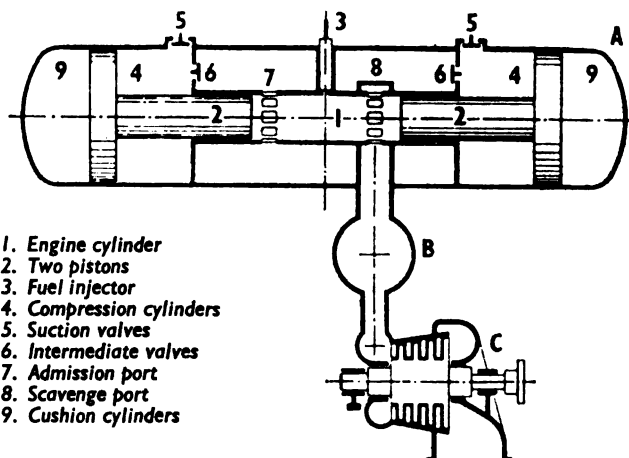


Fig. 1. Section through the free piston gasifier, A; showing the gas collector, B; and the gas turbine, C

The paper described a 6 MW station comprising eight, free piston engines supplying one gas turbo-alternator. Total weight of each gasifier is only 8 tons so that light foundations are possible. With the turbo-alternator, total weight of machinery is 155 tons or 57½ lb/kW. By providing one standby gasifier so that normal maintenance can be carried out on load, 100% availability is possible with a multi-unit station. Shortness of maintenance time possible is indicated by only 2 hours from shut-down to restart to make two piston ring changes.

Future Developments

Where large power outputs are required, there is scope for combining the gasifier cycle with steam plant. The gasifier exhaust gases contain about 80% unburnt air. It would therefore be possible to burn additional fuel, either before or after the turbine, in a steam boiler. For example a 25 MW plant using four gasifiers would yield four times the power obtainable from the gasifiers alone by using a high-pressure boiler between them and the turbine, generating steam at 570 lb/sq in. and 930°F. Overall efficiency would be 34% compared with 34½% for the gasifier alone and 28% for the steam plant alone.

OVERSEAS NEWS



from our correspondents abroad

CANADA

Quebec Annual Report

The financial position of the Quebec Hydro-Electric Commission for the year ended 31 Dec., 1959, was referred to in *ELECTRICAL TIMES* for 3 Nov. The report also outlined technical progress during the year. Peak load on the consolidated system was 2,168 MW, an increase of 8.7% over 1958. During the year the first five of the 11 generators at the Beauharnois hydro-electric station were installed. Each generator has a rating of 73,700 h.p. and this station will eventually be the largest in Canada. At Bersimis 2 station, dam construction was completed and three of the five 180,000 h.p. generators brought into use. The 391 mile transmission line operating at 300 kV linking this station with Quebec City and Montreal was also completed. The line included a three-mile crossing of the St. Lawrence, erected on five towers nearly 400 ft high. A further 300 kV line from the station to Hauteville was terminated. This line will provide additional power for the British Aluminium Co. Baie Comeau Works. During the year the Montreal head office telephone exchange was re-equipped and now has micro-wave communication with Beauharnois, Bersimis, Forestville and Quebec.

New Brunswick Revenue Up

Total revenue for the year ended 31 March, 1960, of the New Brunswick Electric Power Commission rose to \$16.7 million. After allocation of \$384,000 to reserves, \$249,000 remained for transfer to the surplus account. The increase in revenue represents 23.2% over last year, but this was in part due to acquisition during the year of the Grand Falls Plant of the Gatineau Power Co. and associated distribution networks. Generation and purchase of the power rose to 1,185 million kWh and the number of consumers also increased by 16% to 100,745, largely due to acquisition of distribution facilities in the City of Moncton. Acquisition of the Grand Falls hydro-plant raised the Commission's installed capacity to nearly 271 MW. This will be supplemented in August, 1961, by the 250 MW station at St. John. During the year, most of the 35 miles 138 kV line from Moncton to Nova Scotia was completed and construction work began on the further 68

miles from Fredericton to St. John. Increased use of automatic reclosing equipment on h.t. line and use of air patrols had reduced system interruptions by 27% on last year. As part of their effort to improve wiring standards in the province, the Commission have introduced a wiring finance plan whereby customers can finance, by low monthly instalments, the cost of rewiring their premises.

Aluminium Pylons

A lightweight all-aluminium transmission tower designed by Aluminium Co., of Canada, for erection in rugged country is undergoing tests by International Power and Engineering Consultants at Vancouver. The tower may be used for the Columbia River scheme. Total weight is only 3,800 lb and it can be moved to site by helicopter. It has two legs which can be erected in "V" shape or with legs apart depending on the terrain. For either arrangement, only one base is needed. The tower is over 100 ft high and, although costlier to manufacture than a comparable steel tower, it is claimed to be cheaper to erect.

WEST INDIES

Barbados Reaps Development Benefits

Following their acquisition last year of the whole ordinary share capital issue for the Barbados Electricity Corporation, the Mitchell Engineering group have forecast an increase in their number of consumers by the end of the year to 20,000. A representative of the Mitchell group is at present reviewing the expansion plans on which \$240,000 has been spent in the last two years and the intention has been stated to spend a further \$385,000 in the next nine months. It will be recalled that some time ago, the Mitchell group, who are in association with the US firm AMF Atomics, were reported to be considering construction of a nuclear power station in Barbados.

Generating Plant Takeover

Takeover by the Government of the Canadian-owned Demerara Electric Co. is expected to be completed by the end of this month. Towards the end of October, a White Paper was put before the Legislative Council setting out arrangements for purchase of the

company and the establishment of a seven-man Electricity Corporation Board to administer the undertaking. It is proposed to finance down-payment by a loan of £250,000 from Barclays Overseas Development Corporation, repayable in ten years and bearing an interest of 7%. Future plans provide for extension as soon as it is economically practicable into rural areas followed later by more general rural electrification. Hydro-electric possibilities are also being investigated.

New Jamaican Power Station

Savanna-la-Mar now has a 1.1 MW diesel generating power station, which was opened recently by the Minister of Trade. The new station, at Paradise, replaces an old unit which was closed down on 10 Aug.

Grenada Expansion Programme

Arrangements have been completed by the Colonial Development Corporation and the Government of Grenada to expand the island's electricity supply and distribution system. A new company has been formed jointly by the Grenada Government and the Corporation, named Grenada Electricity Services Ltd. This company will take over the Government's existing undertaking, which has an installed capacity of 0.9 MW. The expansion programme provides for distribution networks to towns not at present serviced and an increased generating capacity. Further diesel generating sets are expected to be installed by the end of the year and an investigation is to be undertaken on the relative merits of hydro-electric or diesel power generation for future expansion. The new company has an issued capital of £143,442 representing the value of the Government's assets and £200,000 issued by CDC. The Corporation is also lending a further £50,833 for completion of the expansion programme.

INDIA

Request for Consultants

The Bihar State Electricity Board invites firms of consulting engineers to offer their services for the design, co-ordination, construction and commissioning of two steam power stations during the third Five Year plan. The projects cover augmentation of the Barauni station by approximately 100 MW and the Pathratu station by approximately 250 MW to 300 MW. Details of the consulting ser-

d are obtainable from the
erintending Engineer, Plan-
ject, Bihar State Electricity
1. Tenders are to be sub-
iplicate to the Additional
er, Bihar State Electricity
a, before 28 Dec., 1960.
e superscribed "Tenders for
ervices for Steam Power
1 the name of the tenderers
cover.

ng Plant

plant worth £352,000, to be
a new cable-making plant,
en placed with two British
ustrial Cables (India) Ltd.
1 with Bahrad Steel Tubes.
Engineering Co. (Radcliffe)
supply impregnating plant
sulated cables, and lead
id presses, together with
pment. Stranding machinery
ided by the Trafalgar En-
Ltd. The plant is scheduled
ext August.

PAKISTAN

Technical Aid Offer

ting the Warsak hydro-
t, the new Austrian Amba-
akistan offered technical
nd assistance for hydro-
ation and nuclear projects.
although no formal nego-
so far been conducted with
ustria was impressed by the
: of the Pakistan Govern-
lop the country's resources,
firms and capitalists would
to invest in Pakistan, pro-
ment on deferred payment
e Warsak project was a
eration by Pakistan and
rests.

JAPAN

eneration Projects

ir recently announced long-
ment programme extending
xt ten years, the Kansai

ILE SUBSTATION

ncy standby mobile diesel
plants have recently been
English Electric to Neyveli
oration, Madras. Each sub-
des three diesel alternator
ssociated switchgear. The
are turbo-charged and have
498 b.h.p. They are directly
1,037 kW alternators gener-
V, three-phase 50 c/s. The
onsists of six panels for
rol, alternator and trans-
ctions and outgoing feeders.
aken from the panels by
flexible cables in standard
plug and socket connectors.
stations are designed to start
on failure of supply, and
g at the correct speed the
breaker is tripped and the
eaker closed through elec-
ocks. Restoration of the
ly is carried out manually

Electric Power Co. will install 5,000 MW
of plant. A feature of the project is
a change of policy from hydro genera-
tion to thermal generation burning
heavy oil. This change has been
prompted by lack of hydro resources
available for economic power produc-
tion, reduced cost of generation by using
heavy oil and a prediction, by the com-
pany, that price of petroleum can
be expected to fall in the future. 80%
of the project covers oil-burning sta-
tions in four main centres. A 600 MW
station, later to be extended to
1,000 MW, will be constructed at Sakai
and is planned for completion in 1970.
At Osaka, a 600 MW plant will be
established on land reclaimed from south
of the port. Work is expected to begin
on a second 1,200 MW station in the
Himeji district this year and a 500 MW
station will also be constructed at
Nishinomiya. Agreements with three
large oil companies are being considered
in connection with the fuel supply to
these stations.

AUSTRALIA

Mackay Supply from Queensland

Under a draft agreement adopted
recently by the Mackay Regional Elec-
tricity Board, they will construct an
interconnector linking with the North
Queensland electricity system. The inter-
connector will operate at 66 kV and is
expected to be completed by 1962. It
will link with the Townsville Regional
Electricity Board's system and will com-
prise the following constructional work.
Extensions of 132 kV busbars to Gar-
butt, construction of a 132 kV line from

Garbutt to Clare and a 132/66 kV sub-
station at Clare. A 66 kV line from
Merinda to Proserpine will actually link
the two systems. Load on the intercon-
nector will be approximately 8 MW and
it will serve to reinforce the Mackay
system until a new power station, whose
site has not yet been chosen, comes into
operation in 1968.

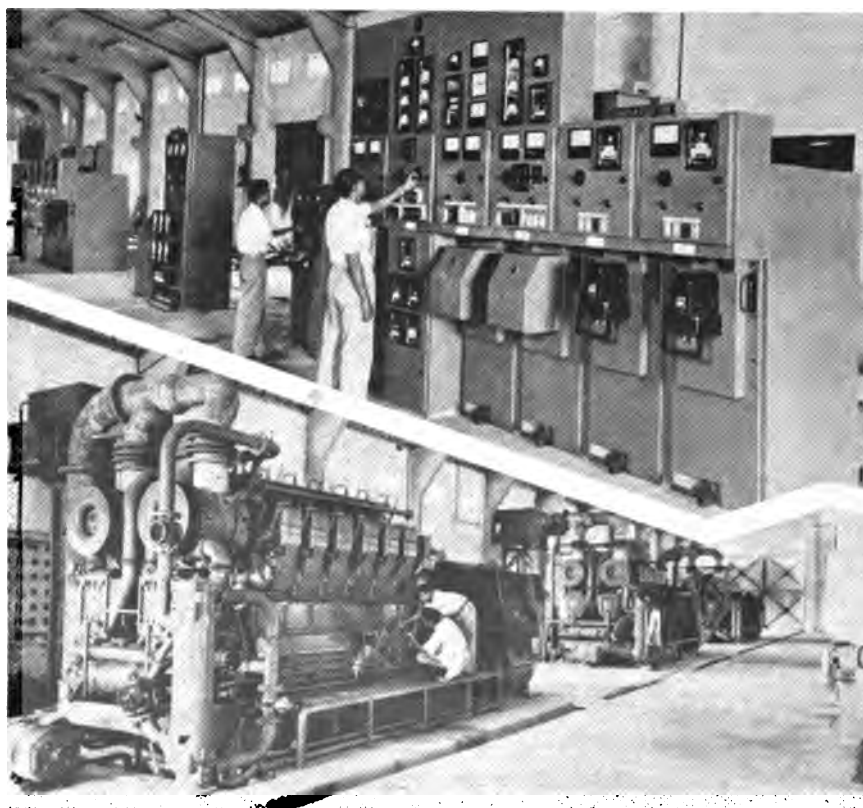
Rail Loco Order Doubled

An order placed by the Queensland
Government with English Electric of
Australia for five locomotives has re-
cently been doubled. Increased traffic on
the Townsville-Mt. Isa line has shown
that the first batch of locomotives, now
in their final stages of construction,
would be inadequate.

NEW ZEALAND

Microwave Telephone in Service

A two-way radio link capable of
carrying 600 simultaneous telephone calls
now links the New Zealand capital, Wel-
lington, with Auckland, 262 miles dis-
tant. The microwave link was supplied
by Standard Telephones and Cables Ltd.
and operates in a very narrow beam
at 4,000 Mc/s. The link requires only
5 W of transmitted power and includes
eight repeater stations carried on 80 ft
high masts. The micro link is designed
to carry television programmes at a
later date if required and there are also
spur connections to Urenui and New
Plymouth. The installation includes
"no-break" power supplies and auto-
matic supervisory equipment using VHF
radio for reporting and identifying
repeater station faults.



Personalities *in the industry*



Mr A. L. G. Lindley



Mr A. F. Miller



Mr S. McD. Gemmell



Mr H. A. Coates



Mr G. D. Kelly

Sir William Strath has been appointed to the board of Tube Investments as from 1 Jan., 1961. He will also be joining the board of the British Aluminium Co. Ltd., of which he will become managing director. Lord Plowden, who is now chairman and managing director of the latter company, will remain chairman. During the war Sir William served in the Ministry of Aircraft Production and from 1945 to 1947 was with the Ministry of Supply. In 1949 he was appointed a member of the Economic Planning Board until 1955. He was a full-time member of the UK Atomic Energy Authority from 1955 to 1959.

Mr A. L. G. Lindley, M.I.MECH.E., has been elected chairman of the General Electric Co. Ltd. to succeed Sir Leslie Gamage, M.C., M.A., on his retirement at the end of the year. Mr Lindley will continue as managing director of the company. Born at Abbey Wood, Kent, in 1902 he joined the GEC as an engineering apprentice at the Erith Works in 1918, and studied at Woolwich Polytechnic. His ability at mathematics and his interest in engineering projects, which demanded meticulous work, soon established for him a high reputation in the turbine and heavy engineering design departments. His success, in fact, took him out of England. In 1932 he was transferred to South Africa and he became chief engineer of the British General Electric Co., of South Africa. Shortly afterwards he was appointed a director and assistant general manager of the South African company. He was also appointed a director of the East Rand Engineering Co. and in this capacity pioneered the manufacture in South Africa of heavy mining and other mechanical equipment. His work led to the expansion of these industries by the South African Government, which asked Mr Lindley to advise on the equip-

ment and layout of new heavy engineering works. These activities necessitated frequent trips to England. On one of these, Mr Lindley narrowly escaped being caught in Rome immediately before Italy entered the war in 1940. He was recalled from South Africa in 1949 to take up the appointment of general manager of the GEC heavy mechanical engineering works at Erith, which he reorganised and expanded to meet the demand for the largest power generating units. He was appointed a director of the GEC in 1953. On Mr Lindley's recommendation the company entered the new field of nuclear energy in 1954 and developed designs for complete nuclear power stations and he became responsible for the company's nuclear energy interests. In 1958, he was made an assistant managing director in charge of the company's heavy engineering group, and in June, 1959, he became vice-chairman and a managing director. Since July last he has been the sole managing director. Mr Lindley is now an internationally known figure in the nuclear energy and engineering world and has frequently visited the US, Canada, South Africa, Australia, India and the Western European countries to discuss with engineers and scientists the development of nuclear power in their areas.

British Insulated Callender's Cables Ltd. announce the appointments of Mr A. F. Miller and Mr S. McD. Gemmell, respectively, as managers of its Glasgow and Aberdeen branches. Mr Miller, who was educated at Leigh Academy and Heriot-Watt College, Edinburgh, joined the former Callender's Cable and Construction Co. Ltd. at Edinburgh in 1938. He served during the war with the Royal Scots and Royal Engineers, after which he rejoined the Edinburgh branch as a sales representative. In 1957 he was appointed branch manager in Aberdeen. Mr Miller succeeds Mr H. Thomson, who has been released for specialist duties with BICC's North East Regional manager. Mr Gemmell, who succeeds Mr

Miller as branch manager in Aberdeen, was educated in Aberdeen and received his electrical training with the former British Insulated Cables Ltd., which he joined in 1940. Before taking up his new appointment he was a sales representative attached to the Aberdeen branch.

The Eastern Electricity Board have appointed two new district commercial engineers: Mr K. W. Brown, at Luton, and Mr N. G. Stevenson, at Chelmsford (*ESH, pages 106, 107). Mr Brown fills the vacancy caused by the appointment of Mr P. B. Clarke as senior assistant commercial engineer (industrial power) at the Chilterns sub-area headquarters. Mr Brown was previously first assistant district commercial engineer at Luton, having earlier served with the London Electricity Board. Mr Stevenson, who is succeeding Mr R. T. Harper, ASSOCIATE I.E.E., on the latter's retirement at the end of this year, is now first assistant district commercial engineer at Chelmsford and prior to joining the Board in 1958 was with the Midlands Electricity Board.

Mr John A. Howie has resigned as managing director and from the board of Lightfoot Refrigeration Co. Ltd. Mr Howie joined Lightfoot Refrigeration in November, 1955, after being general works manager of Enfield Cables Ltd. for about four years.

Chief accountant of Measuring Instruments (Pullin) Ltd. since 1944, Mr H. A. Coates has joined the board of directors.

Recently appointed to the London office of Brook Motors Ltd. as a sales engineer is Mr G. D. Kelly, who has been with the company for four years and was previously in the Production Planning Dept. at the Huddersfield Wks. He had a short period of training at the Huddersfield sales office before coming to London.

Mr Barry Rogel, B.SC.(ENG.), A.M.I.E.E., has left the Wayne Kerr Laboratories Ltd., to take up an appointment as managing director of the newly formed

* Denotes revision to the "Electricity Supply Handbook, 1960."

ary of the Rosemount Engineering Minneapolis, USA. He led the Kerr Microwave design team and in years has made a special study measurement of semi-conductor diodes to extend the use of transistors. In September he lectured on this subject to the Fifth International Instruments and Measurements Conference in Stockholm. Mr Rogel will be to act as consultant to Wayne

Minister of Power has appointed **P. Murray, C.B.**, to be a deputy secretary in the Ministry in succession to **Reginald Ayres, K.B.E., C.B.**, who, retiring on 2 Jan. next. Mr Murray joined the Civil Service in 1929 as an assistant principal in the Air Ministry, he was promoted to assistant secretary in 1940. In 1946 he transferred to the Ministry of Fuel and Power and in the following year was appointed Secretary in charge of the Electricity Division. Since 1959 he has been in charge of Establishments in the Ministry. On the retirement of Sir Reginald Ayres, Mr Murray will be responsible for the Electricity Divisions in the Ministry dealing with electricity, gas, iron and steel, safety and health in mines and quarries. **Mr M. Flett** will be the deputy secretary and will be responsible for dealing with coal, petroleum and minerals and statistics.

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after 40 years' service in the north east coast electricity supply industry (*ESH, page 70). A frequent contributor to our pages over a long period on matters relating to electricity measuring, **Mr Moore** is also the author of two IEE papers on the subject. He gained earlier experience with the Cambridge Instrument Co. Ltd. and was with the Newcastle upon Tyne Electricity Supply Co. from 1921 to 1929, after which he was meter and test superintendent with the Sunderland Corporation. **Mr Moore** was president of the EPEA in 1945, chairman of the Radio and Measurements Group of the IEE North Eastern Centre in 1949-50, and has served on BSI committees. To mark his retirement a dinner was given in his honour last Monday.

Mr W. E. Hind has been appointed manager (home sales) of British Insulated Callender's Cables. His responsibilities cover all aspects of the company's selling activities in the home market. He was previously deputy manager (home sales).

Sir James R. H. Hutchison, B.T., D.S.O., T.D., J.P., has been appointed a director and chairman of Glenfield and Kennedy Holdings Ltd. in succession to the late **Mr H. Cowan-Douglas**. **Mr J. D. Latta, M.C.**, has also been appointed a director.

Mr H. Howarth, **Mr L. Stanworth** and **Mr F. M. Ward** have joined the board of Burco-Dean Ltd.

Surprise! Surprise!! **Mr T. Coates, M.ENG., M.I.E.E., M.I.MECH.E.**, who has been deputy chairman of the North Western Electricity Board from Jan. 1956, has been appointed general manager of the British Egg Marketing Board. Aged 53, he will be the three-year-old Board's first general manager, at a salary of over £5,000 p.a. we understand. Apart from war service—in the Royal Navy (Air Branch)—**Mr Coates** has served in the Electricity Supply Industry throughout his career. Educated at Oundle and Liverpool University, he started as a college apprentice with Metropolitan-Vickers. In 1934 he joined the Liverpool Corporation undertaking, subsequently holding successive appointments, and ultimately as deputy city electrical engineer from 1945. From 1948 to 1955 he was manager of Manweb's No. 3 sub-area. He was also chairman of the IEE Mersey and North Wales Centre in 1953-54. His many friends will join us in wishing him all success in his new sphere, where he starts on 2 Jan.

OBITUARY

Mr H. Peart, representative of Belling and Co. Ltd. on the north east coast, died on 15 Nov.

Mr Harry Moss, M.I.E.E., F.I.E.S., a former well-known electrical contractor in Bradford, died on 20 Nov., aged 81. He retired in June, 1940, from the business which he started before the first world war. He had been a member of the Executive Committee of the Bradford branch of the Electrical Contractors' Association for 27 years, and also acted as hon. secretary of that branch for a long time; and was chairman for eight years. For about ten years he was a member of the National Council of the ECA and its allied associations. A great protagonist of the electrical way of life, while stressing the need for care, he was associated with several early electrical plans before starting up in business on his own account. As manager for the firm responsible, he designed and installed the hydro-electric plant at Grassington, which was opened in October, 1908. This had one 30 b.h.p. vertical shaft turbine operating on an 8 ft head, utilising the waters of the River Wharfe above Linton Falls. He installed electric lighting in several Baildon houses years before a public supply became available and introduced electricity to Eccleshill by persuading the authorities to run the first overhead cables in Bradford. He also claimed to be the first contractor in the country to introduce an easy-payment scheme for electrical installations. His death will be mourned by his many old friends in the contracting industry.

Mr T. L. Moffat, the Scots-born designer of the well-known cookers of that name, died in Toronto on 24 Nov., aged 98. He went out to Canada in 1867 with his father, who started to make ploughs, and **Mr T. L. Moffat** subsequently initiated the cooker business.

Mr G. H. Pearson, O.B.E., A.M.I.C.E., formerly assistant mechanical engineer to the Southern Railway, died on 25 Nov., aged 85.

Mr E. H. Jesty, A.M.I.E.E., technical officer, Chief Engineer's Department of the London Electricity Board, died on 24 Nov., aged 59. Latterly he had been primarily engaged on liaison and budgetary work. He had spent a period in France under the interchange system during which he initiated a strong link with Electricité de France. Prior to 1948 he was deputy mains superintendent with the London Electricity Supply Corporation Ltd. and joined the LEB as technical officer (design and planning). **Mr Jesty** was also a frequent contributor to the ELECTRICAL TIMES, particularly on the early history of the electricity supply industry, of which he had made a close study, and in our Christmas issues of 1950 and 1951 he outlined some of the work of marauding companies which operated without statutory powers in London in the 1880's, and provided some interesting early records. He was a member of the Chief Technical Assistants' Association and the Engineers' Guild.



Mr J. D. Lake



Mr D. N. Hyde



Mr T. Coates

Testing modern instruments

SIMPLIFICATION of testing routine has formed the theme on which Nalder Bros and Thompson have reconstructed their instrument testing. The modernised test routine and equipment will aid the company to meet the quicker deliveries now required for their expanding instrument market by customers both at home and overseas.

It is now 20 years since Nalders were last reorganised completely. With the growth of business and increasing requests for shorter delivery, it was decided to redesign the test facilities on modern lines.

Test Rooms

The new test rooms have been developed over a period of three years and have recently been brought into service. The test-room temperature is thermostatically controlled and a high level of illumination ensures comfort for the employees.

The new rooms have 40 testing desks and these have been carefully planned to eliminate connection errors, at the same time ensuring that they are kept clear of wires. Supplies for testing each particular type of meter or relay are brought to specific desks from generating plant housed in a separate substation. To speed testing procedure, special cables have been installed in under-floor ducting. All tests circuits are made by twin or multiple core cables connected by plug and socket to the test benches and then to the standards or instruments to be calibrated.

Scope of Test Desks

The test desks cover six main testing requirements:

- (1) Calibration and testing of all ordinary ammeters and voltmeters, both switchboard and portable types.
- (2) Three-phase instrument calibration and testing.
- (3) Frequency meter calibration and testing.
- (4) Overload, directional and specialised relay testing and calibration. These desks employ a system of electronic contact amplification for testing.
- (5) A scaling department dealing with individual scaling and accurate printing of instrument scales following calibration.
- (6) A substandards department for calibrating or testing all standard instruments built to special orders. Standard instruments used in other sections of the meter test are also checked on these benches.

In addition to these routine test facilities, the company has installed a thermostatically controlled and timed humidity cabinet for proving instruments destined for tropical use.

Testing Supplies

For high frequency and three-phase calibration and testing, power is obtained from motor-generator sets housed away

from the test room and remotely controlled by push-button for both speed and power factor. One particular machine is thought to be unique. It consists of a motor coupled to four three-phase generators. The machines are, a voltage

generator, a frequency doubler and a current generator combined with a frequency doubler. The machines provide an output ranging from 100 c/s to 800 c/s with complete phase angle control from zero lag to zero lead.



This section of the new Nalder Bros and Thompson test rooms is concerned with calibration and testing of substandard meters

Rationalising equipment production

CURRENTLY carrying out a programme of expansion, MTE Control Gear Ltd. is typical of smaller enterprising firms set up after the war. The company specialises in design and construction of motor control panels and cubicles, also manufacturing the necessary electromagnetic relays and contactors. A wide range of applications is catered for; from sewage-works pumping installations to air-conditioning plant and automatic machine-tool drives.

Simplicity, standardisation and interchangeability may be said to be key words in describing the design and production methods of the company. Resulting from difficulties experienced in obtaining layout draughtsmen, MTE introduced the use of pre-drilled and slotted support members in the assembly of control panels. This not only greatly reduces drawing office time, but gives flexibility of layout and simplifies assembly in the shop. The "modular" concept also extends to relay and contactor design, the emphasis being on unit construction with as many interchangeable components as possible. The number of replacement parts necessary has thus been cut down, making for easier maintenance.

In the design of certain other specialist control devices manufactured, the company have followed a policy of adaptation of simple but effective ideas. One of these, the "Discmag," is an electrically actuated brake for abruptly stopping

machine-tool drives. This, in principle, is a spring-loaded disc friction-clutch with a fixed body. Held released while the motor is running by the series current of the motor, interruption of supply engages the brake, bringing the machine to an immediate standstill.

The firm have solved the problem of sequential switching of solenoid or similar loads with equipment the basis of which is a standard GPO pattern uni-selector. Normally a uni-selector stepping contact cannot make or break loads much above 12 W though they can safely carry a current of 1 A continuously. An obvious, but complex, arrangement to utilise the full current carrying capacity is to employ a number of subsidiary relays, each rated at 1 A breaking, with the coils energised by the uni-selector. In the MTE "Unicontrol" system, only one breaking relay is used, the coil of which is energised to break each time the uni-selector "steps." The contacts of this relay are inserted in the return line of the uni-selector wiper arm, effectively transferring the breaking function from the selector contacts to the relay. Connections to the load are made via plug sockets, the intention being to facilitate alterations to the switching sequence by simply changing-round plug leads from the load circuits. Application of such a system to process or machine-tool control considerably reduces the relay circuitry which would normally be required.

Future for appliance sales

ECONOMISTS PREDICT DEMAND TRENDS

ANALYSIS of future sales trends for four major appliances is attempted in an article published in the November issue of *National Institute Review*.* The overall conclusion is that the fast rise of the past decade must be regarded as exceptional and that in the 1960's demand is not likely to rise at more than 2½ to 5% per year. The review alleges that economists have been too optimistic about the future demand, although in some instances the introduction of much cheaper appliances could alter the

picture. A review of past sales figures shows that for the last 10 years together, sales rose at a rate of 18%/year (at constant prices) from 1950 to 1955, and at 10% from 1955 to 1959. The prospect for 1959 to 1970 is one of 2½ to 5% a year, with no acceleration to 1970. Output is likely to go up a little more in the late 1960's.

It does not mean that consumers will spend increasing amounts on other electrical appliances in the home? The review states that it does not. The four items reviewed were over two-thirds of consumers' total purchases of electrical goods.

For individual appliances, the following preliminary—made—and developed in more detail, of the survey itself:

Washing machines. The upward trend will probably continue in the mid-1960's. On optimistic assumptions, sales by 1965 could reach about 1.3 million, which is about the same as the actual home supplies (as distinct from the total). Capacity in the industry is put at 2 million units.

Vacuum cleaners. Sales may rise to 1.4 to 1.7 million units by 1965, and then level off and fall a little. This is about the same as the 1959 home supplies of 1.5 million and the total of over 2 million.

Refrigerators. Sales are estimated as just beginning to reach saturation. Ownership is rising rapidly. Yet it will not rise above the 1960 level, when about 70 million refrigerators will prove to have been about 7% of the households in the UK bought a refrigerator. Replacement demand will be negligible for many years yet. The industry has capacity for about 100 million a year.

TV sets. Increase in demand will begin to slow down after 1963 to 64. Yet prospects of rise are adjudged as good as for any other of the appliances because of the relatively short life of TV sets, and the end up the replacement demand in the next 10 years. Demand in the mid-sixties is placed at about 1.5 million sets, the lower figure being about equal to capacity. This assumes replacement after six

Causes of Demand Changes

The major part of the survey is devoted to consideration of the effects of various changes in circumstances on demand. Again, these may be discussed under a number of headings.

Income effects. It seems that if real incomes increase by 10%, and other factors remain unchanged, then demand for consumers' durables is likely to grow by between 15 and 30%. Because domestic appliances have on the whole high initial cost and low running cost, HP can be a major factor in accelerating increase of ownership.

Price effects. Prices in real terms are judged to have fallen since 1950. Relative retail prices of TV sets and refrigerators have fallen by a third, those of washing machines by a quarter, and those of vacuum cleaners by a fifth. Price movements such as these may have stimulated demand by 30 to 50%. There is probably some link between income and price effects.

Learning, saturation and replacement effects. Price and income effects do not explain away the whole of the rise in demand. There is a "learning" process. It takes time for consumers to find out about unfamiliar goods. Learning combines with income and price effects to adjust demand to an initial slow rise followed by a fast increase. Then saturation effects begin to come into play. Saturation effects are not necessarily tied to ownership of one only of the appliances concerned; but there may be a pause before there is any general move to ownership of more than one appliance. Thus saturation level is not something that can be fixed ahead for long periods of time. It is relevant in terms of saturation to remember that in the UK the number of households has been increasing; it has grown by over 20% since 1945.

Short Term Outlooks

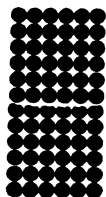
Besides its long term look at prospects, the survey considers the years immediately ahead. For washing machines, it is reckoned that currently 37% of households own an appliance. Some sort of saturation level is predicted at 80% of households, on a basis of people living on their own and of those who prefer laundries. Saturation is likely to be reached in the early 1970's. Sales to new buyers are not expected to rise above 1959 levels, and they will very soon begin to fall. Replacement sales are only just beginning to be significant.

In true short term movements, changes in HP terms account for over two-thirds of total changes in sales. And removal of PT might bring a 20 to 50% increase in demand.

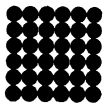
For vacuum cleaners, HP changes account for only about one-third of short-term changes. Abolition of PT might raise demand 15 to 30%. Recovery in output is predicted for 1961.

Refrigerators on analysis showed no clear relation between HP and sales. There is likely to be a bigger link here in the future, with more refrigerators being bought by working class owners.

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Transformers in court



RESTRICTIVE PRACTICES CASE CONTINUES

WITNESSES called by the Transformer Manufacturers' Association are currently giving evidence before the Restrictive Practices Court and being cross-examined by counsel for the Registrar of Restrictive Trading Practices. When the case was resumed on Tuesday last week (for earlier reports see *ELECTRICAL TIMES*, 24 November), counsel for the Association continued his opening address on the question of the electricity supply industry. Previously, he had dealt broadly with general questions and had touched on the question of export. Export prices were the subject of an agreement amongst members of the Association separate from that applying to sales in the UK, he pointed out. However, the Association claimed that the working of the export agreement depended on the free communication of technical and other information amongst members. They would be unwilling to share such information if at a given time they were competing in prices in the home market. In consequence, abandonment of the home agreement would sooner or later lead to less of the export agreement.

On the question of supply industry purchases, it was said that electricity boards had made it clear to manufacturers that each expected the same terms. The Association did not complain of the boards co-operating on this question of price, as they did in matters of standardisation. Manufacturers had consented in 1952 to a cost investigation of large transformers, but this was postponed when a Monopolies Commission investigation was ordered. After the Monopolies Commission had reported, electricity authorities indicated that they would have nothing to do with a cost investigation, on the grounds that the Monopolies Commission had expressed disapproval of a common level of prices.

In 1958, there were discussions about prices for larger transformers to be produced in the future. The manufacturers had suggested that prices should be based on average of all manufacturers' costs for transformers above 50% in excess of the largest ratings manufactured. The

electricity authorities had wanted costs based on the lowest manufacturers' costings, for transformers 100% excess of existing ratings. Subsequently, it was suggested by the electricity boards that future contracts should be on a cost plus basis as a temporary measure.

Evidence

First witness of the Association was Mr R. M. Charley, a consultant with English Electric Company. He said the basis of the Association's agreement was level and level performance. As regards the EE Company business in larger transformers had fallen away so that only 62% of the company's productive capacity was likely to be used, compared with 95% in 1959. In budgeting for an even smaller capacity in 1961 Charley emphasised that a considerable scale of reserve was necessary to meet demands of overseas markets, transformers had to be supplied for higher voltages were required in the UK.

Dealing with competition in export markets in years, he said it was very serious, and the amount of business a company was able to get in the export market was decreasing. The Association price agreement had given tremendous help in obtaining such business. Exit of the Association helped the manufacturers to meet a great variety of requirements by overseas customers. He said he had heard criticisms abroad of level-price tendering based on the assumption that such prices were necessary at an unreasonably high level. However, the critics said that when they had a number of tenders at level price with other features reasonably level, they were able to use their engineering instinct to select the tender most suitable to them. When prices were different, with features also differing widely, it was difficult to decide not placing the order with one of the lowest tenders.

In cross-examination, Mr Charley agreed that the feature of competition in the agreement was in question. The Association had gone a long way in making the agreement favourable to the purchasers by taking an average of the three lowest cost producers. It was not the intention of the agreement to prevent a customer from having the benefit of the lowest cost producer. He felt that price cutting would be inevitable if the agreement was abandoned. Prices would drop to an alarming degree, some firms would be brought to the verge of bankruptcy. However, if some manufacturers stopped production, remaining capacity would accord more closely to demand.

Mr Charley, who was in the witness box for four days, completed his evidence by explaining that competition from local manufacturers applied mainly to transformers, up to a few kVA in rating.

The next witness was Mr R. M. Hobill (general manager, Ferranti Ltd. transformer dept.), who contended that loss of the Association's home price agreement would make the export agreement ineffective. Continental importers quoted "absurdly low prices" in foreign markets.

What it's all about . . .

The ten-member Transformer Manufacturers' Association is defending before the Restrictive Practices Court its agreement providing minimum prices for transformers sold for use in the UK. To succeed, it has to satisfy the Court that restrictions on trading in the agreement are not against the "public interest" as defined in the RTP Act. The Act sets out seven acceptable justifications of restrictions, and the Association is claiming to meet four of these. Briefly, these are: the agreement protects the public against injury in connection with the use of transformers; it brings substantial benefits to purchasers and users which would be lost if the agreement were abandoned; it is necessary to enable members of the Association to negotiate fair terms with powerful purchasers such as the CEGB and area boards; and its abandonment would harm export trade. The case began on Monday, 21 November, and will last several weeks.

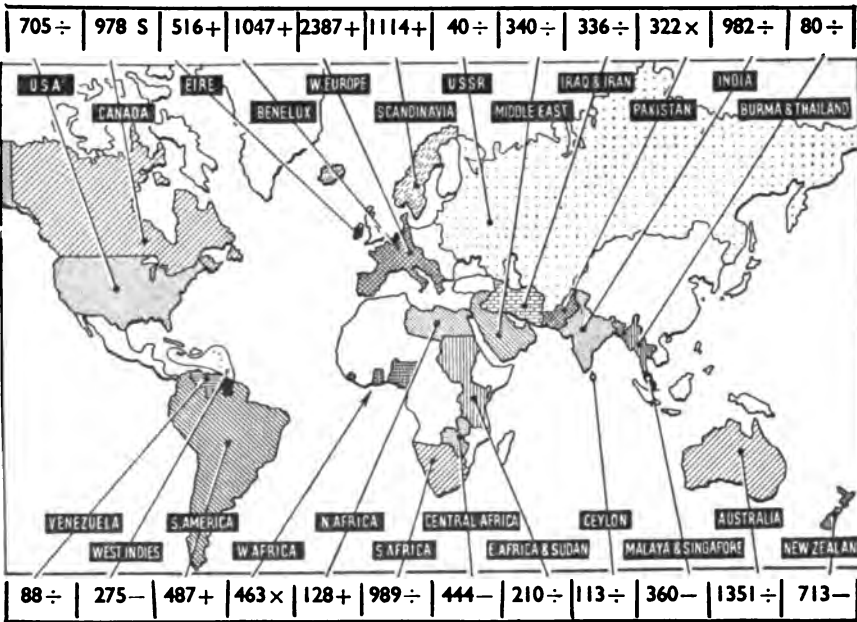
tion of Exports
P's Sterling

- <=over 25% increase
- + =10% to 25% increase
- S=10%+ to 10%-
- =10% to 25% decrease
- ÷ =over 25% decrease
- on previous year's figures.

EXPORTS
IMPORTS

October

OVERING from the serious
line during September, exports
ypes of electrical goods rose to
2-3 million in value last month—
e monthly average for the year.
al for October, although the best
lay (an improvement to some
ue to the ending of the tally-
trike in the Port of London), is
lie different from that of the
nding month of 1959. Compared
t year, the heavy plant side of
stry suffered a sharp reduction
rts, particularly in respect of
mers over 7,500 kVA, exports
h amounted to £367,831 last
as against £1,093,622 a year ago.
ports of radio and electronic
nt were over £500,000 down on
ne month of 1959. But the
e industry shows a more favour-
ne with another steady increase
h washing machines made a
contribution, although domestic
tors suffered a setback.
decline in cable exports con-
ill branches being affected.
ying the markets, by far the
improvement has occurred in
generally, and in Western
y, Netherlands, Italy, Norway
mark in particular, but exports
USA dropped sharply.
ng to electrical goods imported,
e noted that those for refrigera-
e shrunk considerably, but total
imports increased once again.



Description	Exports Value (£)		Imports Value (£)	
	Oct. 1959	Oct. 1960	Oct. 1959	Oct. 1960
Generators				
Diesel up to 200 kW	407,968	200,534		
Diesel over 200 kW	190,511	98,802		
Steam turbine driven	5,041	123,519		
Water and gas turbines	302,147	431,039		
With i.c. and other prime movers	105,340	31,715		
Generators up to 200 kW	135,271	38,240		
Generators over 200 kW	63,206	60,121		
Generator parts	729,530	471,017		
Motors, f.h.p.	319,014	229,152		
Motors 1-250 h.p.	516,025	445,796		
Other motors	368,297	313,563		
Motor starters and controllers	211,646	279,086		
Converters and rectifiers	132,747	154,641		
Transformers	1,759,569	679,440		
Switchgear, to 200 A, mv	346,371	465,221		
Switchgear, other	1,205,682	725,187		
Total, Electrical Plant	6,798,365	4,747,073	460,351	756,955
Batteries, primary and parts	608,331	523,716		
Lamps filament, over 28 V	113,172	62,488		
Lamps filament, under 28 V	31,840	28,223		
Fluorescent and other lamps	101,965	84,850		
Radio and electronic gear	3,846,954	3,316,204	1,450,052	1,675,965
Telephone and telegraphic equipment	1,581,401	1,166,996		
Cookers	51,766	40,836		
Toasters	23,668	28,669		
Other cooking appliances and parts	150,673	116,927		
Space heaters	36,762	37,235		
Water heaters	27,522	22,221		
Other heaters and parts	161,482	149,758		
Electric irons	91,011	76,500		
Vacuum cleaners	140,670	158,477		
Floor polishers	58,107	65,318		
Food mixers	81,365	64,199		
Washing machines, domestic	385,780	832,870		
Dryers		30,045		
Washing machine and dryer parts	86,218	177,724		
Domestic refrigerators and parts	718,796	553,730	182,780	110,547
Other appliances and parts	323,794	363,994		
Total, Domestic Appliances	2,337,614	2,718,503		
Portable power tools	266,229	183,128		
Arc welding plant	50,253	59,269		
Resistance welding plant	25,890	10,689		
Electric furnaces	105,212	80,335		
Signalling apparatus	130,991	98,121		
Commercial instruments	165,661	147,489		
House service meters	133,692	98,434		
Wiring accessories	221,097	146,155		
Fans	77,362	64,653		
Lighting fittings and lanterns	338,286	216,392		
Other lighting equipment	97,502	58,623		
Telephone and telegraph cable	336,809	198,437		
Paper insulated cables	417,166	381,457		
Rubber insulated cables	286,389	191,520		
Thermoplastic insulated cables	258,899	179,193		
Winding and similar wires	138,183	193,546		
Other cables and wires	205,676	147,818		
Total, all cables and wires	1,643,122	1,291,971		
Accumulators and parts	333,127	257,249		
Insulating materials	209,744	164,193		
Electrical ware	87,203	100,733		
Industrial electronic control gear	158,540	227,159		
Permanent magnets	58,981	56,198		
All other articles	2,800,558	2,335,847	1,536,162	1,940,358
Total	22,323,094	22,344,691	4,114,080	5,048,730

POWER SUPPLY

Statistics for October

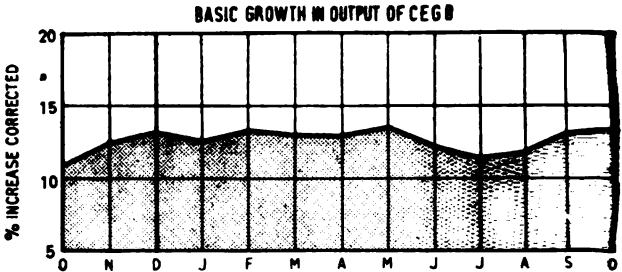
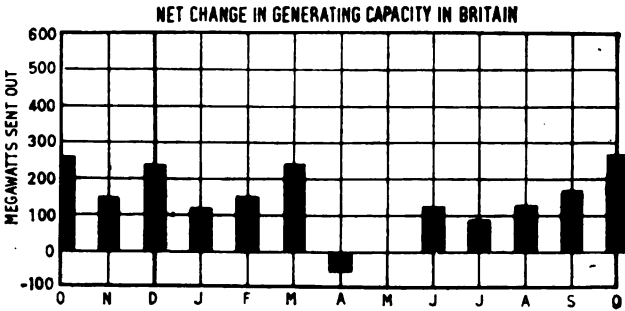
OUTPUT capacity of generating plant rose by 258 MW during October, principally as a result of commissionings by the CEGB shown in the table. The output capacity of the CEGB is now 26,295 MW and the total for the three boards has risen to 29,099 MW, or 6.1%, higher than in October, 1959. Although the set at Skelton Grange "B" is designated No. 11, it is actually the first set commissioned in the "B" station which will ultimately have four 120 MW turbo-alternators. Spondon "H" has back-pressure sets installed and supplies large quantities of process steam to a nearby chemical works.

Electricity sent out by the CEGB rose during the month to 9,048 million kWh. For the NSHEB and SSEB the corresponding outputs were 190 million kWh and 596 million kWh, giving a total for the three boards 15.6% higher than in October, 1959. Referring to fuel consumption, there is a notable decline of 31% in the quantities of coke and breeze burnt and the consumption now amounts to only 1.9% of the coal consumption. On the other hand, coal consumption has risen by 17.2% over the same period last year, and oil consumption is also up by nearly 30% to 480,000 tons.

Electricity Board Sales Progress in October

Board	Electricity sent out in millions of units	% Increase in Oct. 1959
London	788.7	20.1
South Eastern	547.5	14.7
Southern	727.1	17.1
South Western	337.2	18.2
Eastern	882.8	18.1
East Midlands	746.4	17.6
Midlands	985.1	16.9
South Wales	528.6	7.9
Merseyside and N. Wales	573.4	14.7
Yorkshire	980.4	19.0
North Eastern	548.8	16.6
North Western	947.1	14.6
Direct Supplies by CEGB	314.8	1.0
CEGB Total	8,907.9	15.8
South of Scotland	699.6	15.4
North of Scotland	156.0	20.5

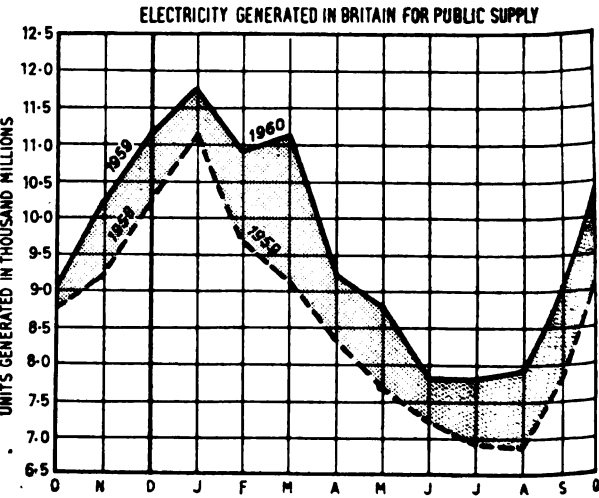
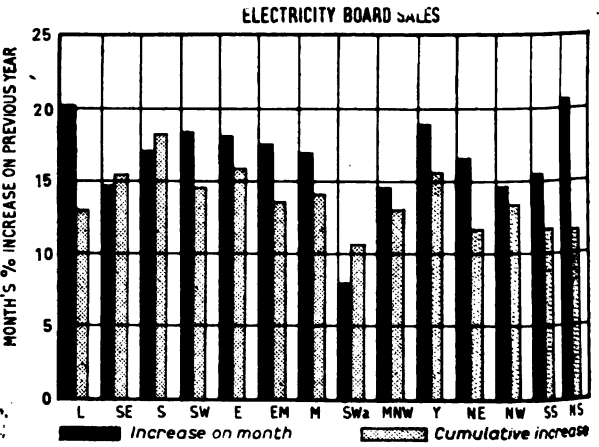
Table excludes area board purchases from other sources



Sales by the area boards show a rise of 13.4% over October last year when the usual corrections have been made for average temperature and number of working days. Before these corrections are made, the increase in sales amounts to 15.6% and, although London and Yorkshire have raised their sales by about 20%, the rise is more evenly distributed among the area boards than last month. Records of sales over the past 12 months show that the Southern Board has the largest increase at 16.2%, but the Yorkshire Board lags only slightly at 16%.

New plant commissioned in October

Station	Plant No.	Alternator MW rating and maker	Boiler klb/hr rating and maker
Aberthaw (SWa)	2	100 C. A. Parsons	755 Foster Wheeler
High Marnham (EM)	2	200 English Electric	1,400 Int. Combustion
Skelton Grange "B" (Y)	11	120 C. A. Parsons	860 Mitchell
Spondon "H" (EM)	26		180 Foster Wheeler



Providing for partitions

NEW ZEALAND INSTALLATION DESIGN

FEATURE that is coming into greater prominence in the design of the office accommodation type of building is partitioning which can be shifted later to comply with changing requirements. The of partition used can vary considerably. This is a where co-operation between architect and electrical engineer is essential to ensure that electrical and telephone services are provided for in the design.

Under construction at present in Wellington, New Zealand, is an 11-storey departmental building, with a total floor area of 227,000 sq ft. Like most State projects it was designed and is being supervised by the Ministry of Works. The building is of reinforced concrete, with false removable ceiling panels suspended below level on each floor. Heating is provided by hot water convectors spaced around the periphery of the ceiling under window-sill level, the pipes and finned heating elements being enclosed in continuous runs of metal casings. Advantage has been taken of these to incorporate, in the base, wiring ducts for power and telephone cabling.

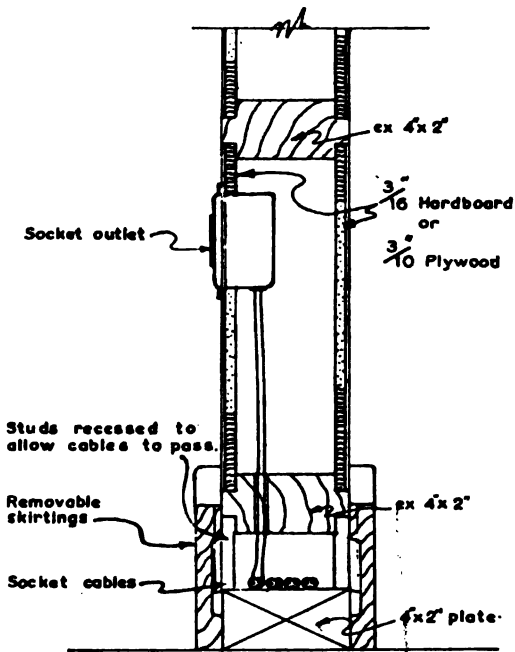
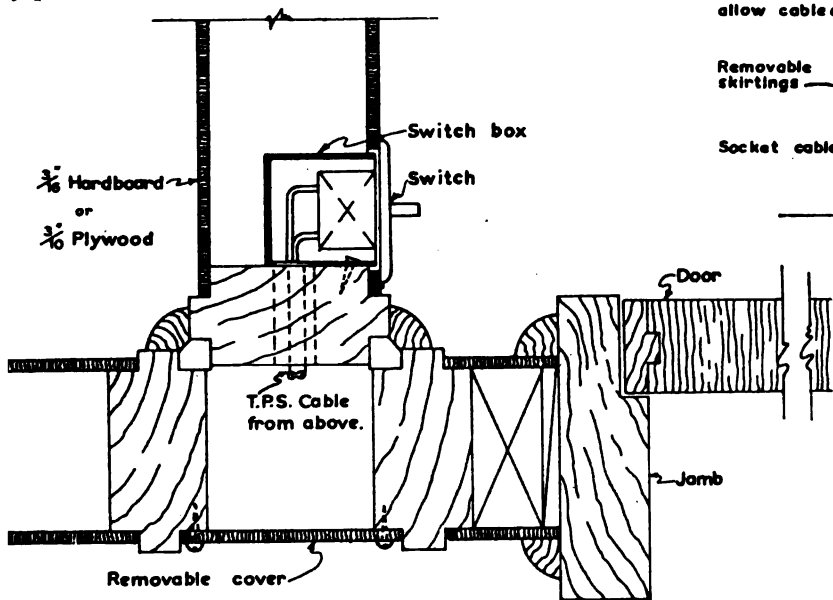
The basic wiring for lighting is run in t.p.s. cabling in the false ceiling space, circuits being first taken to junction boxes and thence to particular room circuits as partitioning below requires. Wiring for socket-outlets is taken into the ceiling space and then up into the partitions in the convector bases above, using conduits to pass through the slab. In addition, provision has been made for outlets which may be required away from partitions

by casting 2 in. by 2 in. wooden plugs into the floor slabs at regular spacings. These can be drilled and outlets wired from the ceiling space below.

The demountable partitions are designed to butt up against the ceilings and to the convector enclosures, and by this means light switch wiring can be led down to switch positions, and extra socket or telephone outlets can be wired across from the ducts in the convector bases.

The partitions are prefabricated in several standard panel widths and in various types to allow for doorways, louvres, junctions, etc., so by choosing the appropriate panel type a wide variety of partitioning can be arranged. The sections are built up on 4 in. by 2 in. rebated studs with adjacent sections bolted with 3 in. wide metal clips. This 3 in. space provides a vertical wiring duct which is covered by a removable panel. In practice the carpenters in the prefabricating shop mount the flush switch boxes and drill the studs and framework as required.

This article is published through the courtesy of the Commissioner of Works, New Zealand Ministry of Works. The system described was mentioned in the Ministry's annual report for 1959-60 as having been developed to suit partitions in any position.



Above: Section of partition at floor level, showing how socket-outlets are wired from duct formed in base of partitioning. Wiring comes up through floor slab to the duct at the base of the partition, main lateral runs being in the false ceiling of the floor below

Left: Plan view of junction of partitions, showing how 3 in. space between two partitions is used as cable duct to bring cable down from false ceiling space to light switches. Studs holding partition facings are drilled before erection to provide path for cables

equipment for industry

Load at a glance

THE problem of measuring industrial mechanical loads, with or without recording facilities, is a diverse one. "Elcontrol" electronic equipment offers one solution of wide adaptation in the industrial field whether the load is in tension or compression. The basic unit, transducer or "load cell," comprises a small container housing a cylindrical high-tensile billet, drilled through the centre and with a number of fine wire strain gauges secured to it. These units can be placed under the feet of the machine, tank, rail truck or hopper or as part of a tensioning device, and the minute variations in length are converted by the gauges to electric signals indicated or recorded on a bridge-type instrument balanced for no-load conditions. The signals can also be used to operate an alarm or trip circuit in the event of overload beyond a prescribed level. *Elcontrol Ltd., Wilbury Way, Hitchin, Herts.*

Compact emergency supplies

IMPROVEMENTS in volume/output ratio of accumulator cells has extended their application to self-contained emergency lighting supply units for buildings. Equipment available consists of "Chloride High Efficiency" cells in conjunction with a battery charger housed in a sheet-steel cabinet. There are three sizes of cabinet, the largest having dimensions 4 ft 8 in. high by 3 ft 5 in. wide by 1 ft 6½ in. deep. Up to 26 cells are used to give voltages of

12 V, 24 V and 50 V, with a maximum capacity of 60 Ah for a 10 hr discharge. The charging unit incorporates a selenium bridge rectifier and 200 V to 250 V input mains transformer, and there are facilities for either rapid or trickle charging via rheostats. Failure of mains supply actuates a mercury switch which connects the battery to the emergency lighting circuit. Similar equipment, but intended for operating theatre lighting, allows for both interruption of mains supply as well as failure of lamp filaments. Emergency lighting is switched on, in this case, by an external relay connected in series with the main theatre lighting circuit. *Chloride Batteries Ltd., Exide Wks, Clifton Junction, Swinton, Manchester.*

High-efficiency bulkhead light

SOMEWHAT unusual is the application of fluorescent lamps to bulkhead lighting. A fitting currently available employs two 6 in. 4 W lamp units, connected in either series or parallel, and having a combined light output said to be equivalent to that of a 60 W tungsten filament lamp. It has a normal pattern cast-iron body with a hinged cover, glass dome and rubber waterproofing gasket. Basic cost is £6 19s 6d, alternative "Perspex" dome and heavy galvanised finish extra. The same firm makes a range of portable bench lights with flexible mounting stems, making use of 6 in. to 21 in. single or twin fluorescent tubes. These fittings are ideal for the illumination of drawing-board and other close work. *Weylite Ltd., Orchard La, Alton, Hants.*

Plating thickness measurement

THICKNESS of industrial protective coatings, plating in particular, is of some importance in defining anti-corrosion properties. Several types of instrument are available to cover thickness measurement of a wide range of coatings. The "Kocour" thickness tester uses a coulometric method for measurement to an accuracy claimed to be $\pm 5\%$ for a thickness range between 0.000004 in. and 0.0015 in. A sample area of plating is immersed in a standard stripping solution and the cell so formed connected in series with a special integrating meter which gives readings proportioned to electrolytic current density multiplied by time. When stripping is completed, plating thickness can be estimated from the number of coulombs passed. A second instrument, the "BNF" gauge, is designed specifically for nickel plating on steel, but can also be used for nickel-plated brass. Its principle of operation is based on the thermo-electric effect of the junction of dissimilar metals and measurements are made with a test probe used in conjunction with a meter. Although less accurate than the first instrument, it has the comparative advantages that readings can be taken rapidly and by a non-destructive method. Two further instruments available can be used for thickness determination of non-metallic coatings; one, for coatings on magnetic materials, the other, suitable for anodic coatings, making use of eddy current interference effect. *Nash and Thompson Ltd., Hook Rise, Tolworth Surrey.*

An adjustable work-light

FINGER-TIP precision adjustment in any position within its radius of action is claimed for a spring-counter-balanced type incandescent lamp support. This also provides for the lampshade fitting itself to be directed at all required angles. Several models are available, having either two or three articulated steel arms, with a choice of arm length. The aluminium lampshade, together with the support, is supplied stove-enamelled in any of six colours. The support can be fitted either with a portable desk-top base or one of five brackets for various permanent mounting situations. Of Norwegian origin, it is said to be competitively priced. *The 1001 Lamp Co. Ltd., 66 Tyrwhitt Rd, S.E.4.*



▲ Weylite high-efficiency bulkhead fitting employs two 6 in., 4W fluorescent units

◀ Compact emergency lighting supply unit uses up to 26 Chloride accumulators with maximum rating of 60 Ah

Spring counter-balanced work-light allows precision adjustment to any position



for the electrical trade

pie-baking

BAKER built on much the lines as the popular "Rotiss-barbecue and coming from the re is being introduced. It is vn as "Bake-O-Mat." Similar to the barbecue, it accom- many as 70 3 in. pies in ended from a rotating spit. by a 6.1 kW infra-red ele- fibreglass-insulated cabinet 13½ in. high by 32 in. wide deep. A 1 kW warming oven dimensions, which also acts for the pie-baker, is available a total price of £460. "Bake-one is priced £350, and the :143. Delivery from stock. it Ltd., 67 Jermyn St, W.1.

tion in date clock price

JCTION of over £17 in the price of an electric calendar nounced. The clock now sells 3d instead of £41 2s 6d. It an ordinary clock-face on a g walnut panel with a day/ indicator below it. The adjusts itself for leap years ily. *Hadley Telephone and tems, Smethwick, Staffs.*

tech for all appliances

TABLE time-switch for domes- appliances is announced which any electrical equipment on at and off after a pre-selected he switch, known as "Auto- mprises a 24 hr dial and a ree-pin socket-outlet, mounted e plastics base. A transparent shield covers the dial. "Auto- simply plugged into a socket appliance to be switched on



" the time-switch which will turn tic electrical appliance on and off ch 24 hours at times set on the dial.

plugged into the built-in outlet. Two pre-selected "on" periods can be set for every 24 hr, they may be of any duration down to a minimum of 30 mins and will operate regularly without daily resetting. Applications of the time-switch are numerous. It can operate an electric blanket, switch on a radio or heater and even defrost a refrigerator. A pilot light indicates "on" periods. It stands on rubber feet and is supplied with 1½ yd of mains lead. Price £5 17s 6d retail. Dimensions are: 9½ in. long by 4 in. wide and 5½ in. high. *Venner Ltd., Kingston By-pass, New Malden, Surrey.*

New numbers for Pakamatic

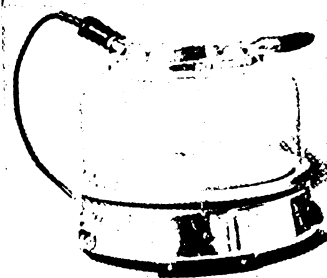
PAKAMAC inform us that their two refrigerators have been allocated new identification numbers. The 4 cu ft (350) is now known as "Pakamatic" 400 and the 2.8 cu ft (250) as "Pakamatic" 280. *Pakamac Special Products, Melbourne Mill, Chadderton, Lancs.*

Cooking without cramping

COOKING appliances for bed-sitting- rooms or smaller flats form a field of increasing importance, calling for compact yet versatile design. An example of a unit which meets this challenge with marked success is the Rönisch "Clear-View" table stove. This cooker, a German import, will stew, roast or bake many items which would normally be allotted to a grill or oven. It comprises a circular heated plate covered by a heat-resistant glass cover which embodies a further heating element at its top. This unit should have a special appeal since the general trend in full-scale cookers favours a transparent oven door.

The heating elements both have a loading of 400 W and are operated separately from a single four-position switch. Selling price is £10 10s, and that includes drip pan, grill, wire dish support and heat-proof glass dish as well as lead and plug.

Another useful item which might well make a companion piece to the table stove is a boiling ring, selling at only £4. The spiral three-heat element is mounted on a square casing, 5 in. high, finished in cream, white or blue baked enamel with chrome trimmings. It



Above: The £4 cooking 'ring for the bed-sitter. It has 1,200 W loading

Left: The "Keylock" transparent table oven has elements in base and lid. £10 10s

has black handles at each side. The element, of the black-heat type, has up to 1,200 W rating. There is a double-plate version of this unit available at £8 5s, which has a white cover and pilot light.

These appliances are being marketed under the trade name "Keylock" and all replacement spares are available from the distributors. *Armorduct Trading Co., 1-3 Brixton Rd, S.W.9.*

Wash-spin combination

AS a result of their takeover of W. and S. Summerscales, Goblin have added a tandem washer-spin dryer to their range of appliances. Known as "Double G," it is identical in appearance to Summerscales' "Doublespin," but though its spin dryer now has a separate motor and pump, it sells at only slightly more. Washing and drying functions of this two-tub combination are independent and the spin dryer side of the unit is used for rinsing. The washer operates on the agitator principle and employs a 3 kW heater.

Two simple controls and a pilot light are placed in a recessed panel on the front fascia. This model has an outer casing of "Stelvetite" plastics-coated steel, which gives it a highly durable decorative finish. Dimensions are 31 in. high by 33 in. wide by 18½ in. deep. "Double G" sells at £76 16s tax paid. Laminated table top is £3 3s extra. *Goblin (BVC), Goblin Wks, Leatherhead, Surrey.*

Higher loading for water heater

THE "Stelvetite" cased thermal storage water heater, "Lincoln," is now available with 3 kW loading. It was originally available at 2 kW only. "Lincoln," which is finished in white or cream with red or blue trimming, has a 2.6 gallon capacity and sells at £12 12s 11d, tax paid. *Santon Ltd., Newport, Mon.*



Multi-way socket-outlet

A SOCKET-OUTLET for use on an extension lead, which accommodates four 13 amp plugs in a single housing, is now available under the "Briticent" label. A four-way 5 amp outlet has been available for some time. For use in workshops, laboratories and commercial



The "Briticent" four-way outlet is fused and shuttered

TRADE PUBLICATIONS

POULTRY AIDS.—Pamphlet describing electronic poultry controls for brooders and electronic lighting and ventilation controls for broilers. Electronic Poultry Aids, Kimpton, Hitchin, Herts.

E.M.O.—Plastic slide-chart giving quick reference data on R series bearings; deep groove, light inch, low torque. E.M.O. Instrumentation, Western Rd, Bracknell, Berks.

I.C.I.—12-page booklet, "Silicones—Properties and Products." Imperial Chemical Industries, Nobel Division, Stevenson, Ayrshire, Scotland.

METWAY.—56-page illustrated catalogue and price-list of replacement elements. Metway Electrical Industries, Metway Wks, Canning St, Kemp Town, Brighton 7.

PETBOW.—Technical leaflet describing an arc welding generator. Petbow, Sandwich.

HOLOPHANE.—Technical leaflet describing bi-way bowl refractors, 2/4135 and 2/4140F, for use with fluorescent bulb, mercury discharge and tungsten lamps. Holophane Ltd., Elverton St, S.W.1.

WARD.—32-page illustrated catalogue entitled "Rails and Rail Accessories"—railway track materials, crossings and turnouts, lever boxes, buffers, etc. Thos. W. Ward, Albion Wks, Sheffield.

DAWE.—French catalogue of stroboscopic equipment. Dawe Instruments Ltd., 99-101 Uxbridge Rd, Ealing, W.5.

ATOMEX.—Leaflet entitled "Atomex Immersion Gold Solution" describing process of applying coating of gold to nickel, etc., for use in printed circuitry. Englehard Industries, Baker Platinum Division, 52 High Holborn, W.C.1.

GRIFFIN.—53-page illustrated catalogue of volumetric and lampblown glassware. Griffin and George Ltd., Ealing Rd, Alperton, Wembley.

D. AND T.—57-page comprehensive price-list of precision fasteners turned from the bar, i.e., cut thread screws, nuts, bolts, washers. Davis and Timmins, Billet Rd, Walthamstow, E.17.

FALKS.—56-page catalogue of industrial lighting fittings, Catalogue No. 819/60, and a brochure entitled "Falks Lighting Service" which describes large-scale lighting schemes for public buildings and commercial premises. Falk, Stadelmann and Co., 91 Farringdon Rd, E.C.1.

TROIDAC.—Set of technical leaflets giving details of voltage regulators. No. 25, resin cast; No. 10, resin cast; No. 20, air cooled and No. 40, air cooled. Foster Transformers, South Wimbledon, S.W.19.

ACCESS.—Set of leaflets on equipment for overhead work, including Tallescope aluminium telescopic work platform, Giraffe and Beanstalk hydraulic working platforms, Wall Spider, Mountie safety steps, Zip-up staging. Access Equipment, Maylands Ave, Hemel Hempstead, Herts.

establishments, the new outlet eliminates the necessity for long leads on all portable equipment. It has a square face, 5 in. by 5 in. with a three-pin socket in each corner, the supply lead entering through the side. Provision is made for wall mounting or suspension. Each outlet is shuttered and a 13 amp fuse is provided. All contacts are formed from continuous brass strip mounted edgewise "ring-main" fashion, and embedded in rubber or neoprene. Incoming mains are protected against direct strain by being looped around an insulated post in the centre of the unit. All screws within the housing are captive. Net trade price: £3 5s, neoprene; £2 15s, rubber. British Central Electrical, Briticent Hse, 6-8 Rosebery Ave, E.C.1.

Domestic heat pump

THE Jonmil heat pump, which was mentioned in ELECTRICAL TIMES, 13 Oct., News of the Week, in connection with a show house, is soon to be available through electrical contractors. The pump can provide refrigeration, central and water heating, the hot end having an output of about 12,000 thermal units. Prices, including installation costs, are: Mark I central heating and refrigeration unit, about £220; Mark II central heating, refrigeration and

water heating unit, about £250. Though intended primarily for installation in new houses the pump will be available for installation in existing houses early in the new year. A same-day maintenance service is to be provided. Jonmil Building Development Ltd., 16 Carlisle St, W.1.

Wall-mounted heater

THE "Capella" suite is a framed, wall-mounted heater designed to take the place of a fireplace. The 2 kW bar- or rod-type fire is set in a broad rectangular golden mesh, with a final sturdy frame of wood projecting 5 in. from the wall. A diffused light is shed on to a rear panel from behind the fire's casing, providing a decorative illumination even when the fire is switched off. This arrangement, one which has become increasingly popular recently, seems to be a favourite substitute for the hearth which is fast disappearing from modern homes.

"Capella" is noteworthy for its low price. The suite is sold complete for £15 13s 6d tax paid. The rod-type fire version has chromium reflectors and is slightly more expensive at £16 18s 3d. Dimensions: 26 in. high, 38½ in. wide and 5 in. deep. Carron Co., Carron, Falkirk, Stirlingshire.

BRITISH STANDARDS

Galvanised Mild Steel Wire for Armouring Cables. BS 1442: 1960. This is a revision of the original specification published in 1948. In the original, resistivity of the wire was stated as an ohm/mile constant but it was not a specific requirement. Since the use of non-metallic sheathed cables is on the increase, when the resistance of the armour becomes more important, it has been considered more suitable for the maximum values to be expressed in ohms/1,000 yd at 20°C for each size of wire and to make the maximum values mandatory. That is the main change in the new standard. Wire for armouring submarine cables will be covered, as previously, by BS 1441.

Fixed Wire Wound Resistors for use in Telecommunication and Allied Electronic Equipment. BS 2111: Pt. 1: 1960. Price 10s. This is the first of two parts in a series dealing with components for use in telecommunication and electronic equipment and concerns fixed wire wound resistors. Part 1, now available, covers general requirements and tests; the second part, to be published shortly, will list standard sizes and ratings. The standard follows the usual pattern and applies to insulated and non-insulated fixed wire wound resistors up to 200,000 ohms with a dissipation of not more than 200 W at 70°C.

Non-reversible Connectors and Appliance Inlets for Portable Electric Appliances. BS 3283: 1960. A new stan-

dard, separate and distinct from BS 562, for connectors and shrouded pin sockets, or appliance inlets, on domestic electrical appliances but with shrouded earthing contacts. It is intended that BS 3283 will eventually supersede BS 562 but, since so many appliances with the earlier design are in use, the older standard will remain in force for an indefinite period. BS 1671:1951, "Domestic Electric Kettles," is being amended to specify the use of the new connector which is nominally rated at 13 A, 250 V and is, of course, non-reversible.

Dimensions of 3-phase Electric Motors. Pt. 1: With Ventilated Enclosures. BS 2960: Pt. 1: 1960. Price 6s. This is an amendment to the 1958 standard with a number of alterations, the most important of which is the inclusion of maximum overall dimensions for foot-mounted motors as Appendix C, left blank in the 1958 issue, the inclusion of a table of effective lengths of keyways and a renumbering of tables and clauses. The purpose of the amendment is to rationalise the 1958 standard in order to bring a revised BS 2083 in as a second part. When this is released, both the revised and old standards will remain in force for a transitional period before BS 2083 is withdrawn. The amendment will be issued free of charge to all holders of BS 2960:1958 and will be included with copies ordered in future. Copies of the above standards may be obtained from the British Standards Institution, Sales Branch, 2 Park St, W.1.

News of the Week

General Electric cut cooker, 'fridge prices

Rebate on traders' present stocks

THIS week's bombshell for the appliance market is a sharp drop in the retail of all General Electric Co.'s cookers and refrigerators. But no price concessions for other domestic equipment are envisaged by the group, a GEC spokesman told the ELECTRICAL TIMES yesterday. GEC is not the first firm to cut refrigerator prices, but now this producer is setting a stiff pace in the cooker field also. Price of the "Estate" cooker has been reduced from £35 to £33, the "Superb" from £65 to £62 10s and, significantly, the "Estate," sold in bulk to housing authorities on a narrow profit margin, from £28 to £26. Cuts on refrigerators range from £12 10s on the 8 cu ft model, 12 10s, to £3 4s 6d on the 2½ cu ft, bringing it down to £45 3s. Traders will be relieved to know that GEC has decided to reimburse them the whole of the difference in face value on their present stocks, though still forfeit the difference in purchase price. In return, GEC expects retailers to maintain the new retail prices. Though simultaneous, the cuts in cooker and refrigerator prices are being made for widely different reasons. Cooker sales generally were already rising and GEC decided to give added impetus to this trend in order to maintain a high level of production at their

Yorkshire works and so curb costs. GEC say their share of the cooker market is now almost 15% and looks like becoming larger than ever before. The move has nothing to do with the prospective merger with English Electric, and GEC is not lining up prices with EE, a GEC spokesman said. In the case of refrigerators, the market picture is by no means so rosy, and the price cut has been made to help clear some of the half million refrigerators of all makes at present drugging the home market. GEC say that until these stocks are reduced, new models cannot be introduced, with the result that Britain would fall behind in design and lose overseas markets.

No Electrical Forum

EFFORTS to form an "Electrical Forum" to replace the Electrical Fair Trading Council when it is wound up at the end of this year appear to have failed. At a meeting called by Mr T. W. Heather on 21 Oct. (ELECTRICAL TIMES, 27 Oct.), trade organisations within the industry were asked to indicate their views on setting up an investigating committee to look into the possibility of such a forum in which matters of general interest to the electrical industry could be discussed informally. It appears that insufficient support has been forthcoming even for this preliminary step of forming an investigating committee.

Objections to Nevis Scheme

SEVENTY-SIX societies and individuals lodged objections to the proposed Nevis hydro-electric scheme of the Scottish Hydro-Electric Board (which we referred to on 13 Oct.). That includes Inverness County Council, William District Council and British Aluminium Co., whose objections are understood to be legal grounds for the protection of possible fisheries. Main objector is the National Trust for Scotland, whose case is based on amenity and economic grounds. A final inquiry will probably be held.

LINE FROM WEST BURTON

OPPOSED supergrid transmission from West Burton, Notts, to Watlington, Herts, is meeting opposition from the line would run by way of Lynn and Cambridge. The Lincolnshire branch of the Council for the Protection of Rural England is against the route, and the Planning Committee of Kesteven County Council are opposing the proposed route in Kesteven and asking for an alternative plan.

Kingston fuel probe

SCOTLAND YARD have been called in by the CEGB to make investigations into alleged frauds involving records of fuel deliveries to Kingston power station. According to reports, there are allegations that lorry loads of fuel had been driven into the station at one gate, weighed and booked in, and then driven out through another gate without being unloaded.

Engineering pay deadlock

A WAGE increase offer by the employers' side in the engineering industry was rejected by union representatives last week. The latter met at York on 8 Dec. to decide on the next move. The unions had asked for a flat increase of £1 a week, but this was turned down by the Engineering and Allied Employers' National Federation, who first offered increases of 6s a week for skilled men, 5s 6d for semi-skilled, 5s for unskilled and 4s 6d for women employees.

When the union's refused these they were offered an additional 1s all round, but this, too, was rejected.

The last pay increase in the engineering industry took effect in October, 1958, but in March last the working week was reduced from 44 hr to 42 hr without loss of pay.

H.E. in N. Ireland

A HYDRO-ELECTRIC plant in the Mourne Mountains is a feasible means of generating electricity, investigations have disclosed. This news was given by Lord Glentoran, Minister of Commerce, last week, but he pointed out that until he had completed an examination of different possible schemes it would be unwise to assume that pumped-storage plant would form part of Ulster's next programme of development.

Mechanicals lose rating appeal

THE appeal by the Institution of Mechanical Engineers against the decision of the Court of Appeal that the Institution was not entitled to exemption from rating under the Scientific Societies Act 1843, in respect of its premises, was rejected in the House of Lords last week. This was a test case undertaken on behalf of the senior institutions to elucidate their position.

In the earlier appeal it was held that the I.Mech.E. was not instituted for purposes of science exclusively, and was not supported wholly or in part by voluntary contributions.

Giving judgment in the Lords, Viscount Simonds pointed out that in Clause 7 of the Institution's Charter the word

"science" occurred once only, and then in the phrase "education in engineering science and practice." So far as "mechanical engineering" connected scientific work, it must involve art and practice also. On the second question—the object of the members in joining—he considered it strained credulity too far to claim that they paid their annual subscriptions in a spirit of altruism and without regard to the advances that they obtained from membership. He could not believe that a material benefit was not derived from use of initials indicating membership. Lord Radcliffe and Lord Reid concurred, the latter emphasising that members' subscriptions were not "voluntary contributions."

HOLME PIERREPONT STATION INQUIRY

THE proposed Holme Pierrepont power station is to have four 500 MW turbo-alternators, and the site could accommodate a second station of similar size, it was stated at the public inquiry at Radcliffe-on-Trent last week. Fourteen organisations and authorities opposed the scheme mainly on the grounds that it would be in the green belt and close to residential property and absorb good agricultural land. It was said that within a one-mile radius of the site there are 78,000 people. Mr D. Cowley, representing the West Bridgford and Bingham Councils, contended that West Bridgford would lose £2 million in rateable value if the station was built.

Outlining the proposals, Mr S. B. R. Cooke, Q.C., for the CEBG, said there would be two 650 ft chimneys and eight cooling towers 375 ft high. The site of 525 acres was sufficient to accommodate a second station of the same size, but that would need permission at a later date. The Board had already asked for consent of the Minister of Power to develop a site at West Burton (for a similar station), which had the approval of the local planning authority.

For the Board, Mr F. Faux, station planning and development engineer, pointed out that, technically, Holme Pierrepont had the combination of qualities which made it outstanding for electricity generation—nearby coal mines, ample water supply, good foundations and railway connections, and convenient to existing main transmission lines. The station was planned to be in commission in 1966. A second similar station would be required before 1970. Ash could be disposed of locally by the County Council or could be taken by rail to the Peterborough area, where it could be deposited for many years to come.

There would be eight miles of railway sidings at the station and at full operation there would be a coal store of 2,000,000 tons occupying 45 acres at a depth of 30 ft.

Questioned by Mr J. P. Brockbank, for Notts County Council, he said the CEBG would consider extending High Marnham some time in the future. The limit of cooling water which could be taken from the Trent had not yet been reached, but the River Board could see the limit ahead when the Holme Pierrepont station was completed.

Later, Mr Brockbank also argued that, on the Board's figures of fuel for Holme Pierrepont and West Burton, they would require 12 million more tons of coal a year than was locally available, for the NCB had stated that the maximum amount they could make available in 1968 would be 24 million tons a year.

Subsequently, Mr F. R. Hunt, of Planning and Development branch, CEBG, explained that all the conclusions reached by the Board were based on Holme Pierrepont not using more than five million tons of coal a year in the first stage.

On Friday, Mr Hunt said a third Nottingham power station might be built on another site along the River Trent. This would probably be constructed before either of the second stations were built at Holme Pierrepont and West Burton, but its construction depended upon whether coal would be reasonably available.

The inquiry continued on Tuesday, at the Shire Hall, Nottingham. Owing to the outbreak of foot and mouth disease in the area, the three inspectors conducting the inquiry (Mr H. W. Grimmit and Mr W. L. N. French, MoP, and Mr D. Senior, MoH) would be unable to inspect the site just now.

Microwave conference

RECENT advances in microwave measurement techniques will be discussed at a conference being organised by the Electronics and Communications Section of the IEE to take place in London from 6 to 8 Sept., 1961. Papers on related topics will be welcomed, and intending authors are invited to submit abstracts of up to 250 words by 15 Feb.

S.W. flood damage charge

FIRST-AID repairs to consumers' electrical installations damaged in recent West Country floods cost the South Western Electricity Board £1,650—but the Board has waived the charges. This was reported to the Devon Committee of the Electricity Consultative Council last week by Capt R. C. Wield, council secretary, who pointed out that some of the Board's men, even though their own homes were flooded, remained at work where their skill and knowledge were required. Many men displayed courage and ingenuity, and worked long hours in their devotion to duty.

OFFICIAL PUBLICATIONS

BS 1332. Guide to civil land aerodrome lighting. 12s 6d.

Mechanical and Electrical Engineering, including energy conversion, transmission and storage; atomic energy; pumping, blowing and compressing machinery; explosives and ordnance. Synopsis of historical events. Science Museum. HMSO. 3s.

Gas in Europe, 1960. Production, Availabilities, Consumption. OEEC Report. 12s 6d.

Import Duty Drawbacks (No. 13) Order, 1960. S.I. No. 2139 (see page 862).

Peak Sales in West

SWEB lifted sales by 12%, or 176 million units, in the first half of this financial year compared with the previous corresponding period, the chairman of SWEB, Mr A. N. Irens, said at the switch on this week of a £25,000 project improving supplies in the South Hams area. The project comprised replacement of old switchgear at the Kingsbridge substation, a new 11,000 V line to give Bigbury and Kingston a more direct supply from Kingsbridge, and a new alternate link for these areas from Modbury, making electricity available to 34 more rural properties at the same time.

EXTENSIONS FOR JERSEY

THE Jersey Electricity Co. Ltd. is seeking to raise £1 million for development work including the purchase of new generating plant valued at about £150,000. The company is controlled by the State of Jersey, which already owns all the Ordinary share capital, and the island's Parliament is being asked to approve a recommendation of its Finance Committee that it should take up an additional 1,000,000 £1 Ordinary shares in the company.

The new generating plant is to be installed in 1962.



At the inauguration of the 3 MW gas-turbine station at Lynton, Devon, to which we referred last week. Left to right, Sir Alec Coryton, deputy chairman, Bristol Siddons Engines Ltd., Mr A. N. Irens, chairman, S. Western E.B., and Sir George Hayton Hames, chairman, Devon C.C., at the switch-on ceremony. The machine's alternator was supplied by Electric Construction Co. Ltd. (and English Electric in previous years) — stated)

ELECTRIC BLANKET SAFETY QUESTIONED

STATISTICS for fires caused by electric blankets were given in the House of Commons last week. Mr D. Vosper, Minister of State, Home Office, said that the number of fires attended by fire brigades that were judged to be caused by electric blankets were 244 in 1957 and 396 in 1958. Figures for 1959 will be available shortly. Number of deaths reported in which electric blankets were involved were one in 1957, ten in 1958 and seven in 1959.

Mr Vosper was replying to a question from Miss A. Bacon who drew attention to a *Which?* report that 20 deaths had been caused by electric blankets in the three years, and 2,600 fires reported by insurance companies in one year alone.

Mr Vosper pointed out that BSI was drawing specifications for electric blankets, and that the Home Office is undertaking a survey of "all fires caused by electric fires" (presumably fires of electrical origin) during the last two years.

College plans for nuclear reactors

Colleges have asked the Government for grants to cover the cost of building a low-powered nuclear reactor part of their training facilities for engineers and physicists. This was stated in the House of Commons on behalf of the Minister of Science. Reactors are proposed by Birmingham, Imperial College and Queen Mary College, London; Manchester and Liverpool jointly; Southampton; and the Scottish Universities jointly with the Royal College of Science and Technology, Glasgow.

In another Parliamentary answer it was said that facilities for training nuclear engineers and reactor physicists are provided at Birmingham, Durham, London, Manchester and Southampton Universities so far as England and Wales are concerned. In recent years about 90 students have taken post-graduate courses in such subjects and about 100 students have chosen nuclear engineering or nuclear physics as a special subject in the final year of their undergraduate studies.

Copper consumers oppose fixed price

ATTEMPTS by copper producers to bypass the London Metal Exchange by establishing a fixed price for copper appear doomed to failure in the face of world over-capacity and opposition from consumers. British and West German fabricators are against a fixed price, and there has been a change of heart among half a dozen countries who formerly favoured the idea. Belgium, France and Finland stand almost alone in favouring some form of fixed price in Europe. This was revealed during informal discussions in Paris at the recent biennial meeting of the International Wrought Non-Ferrous Metals Council, which provides a forum for European fabricators and their suppliers. The main hope of producers seems to be to continue to limit output.

Cookers go Ahead

THE production of electric cookers is now nearly equal to that of gas cookers. That is the conclusion for the latest figures in the hands of the Modern Cooking Promotional Committee. This follows the substantial rise in cooker production this year, amounting to 348,406 for the first nine months, compared with 298,680 for the corresponding period last year. This increase of no less than 17% is one on which the Committee can look with some pride as a tribute to their many activities in promoting electric cooking.

SHAVER PARTS DRAWBACKS APPLICATION

THE Board of Trade are considering an application for the allowance of drawback duty on certain parts for electric shavers when re-exported. The items concerned are blades and heads, and base metal parts of blades and heads. Interested parties should make representations to the Tariff and Import Policy Division of the Board of Trade.

Higher tariffs likely in Midlands

MIDLANDS EB will have to lift revenue by over £3 million a year in order to meet higher costs, the Board chairman, Mr W. S. Lewis, has warned the Consultative Council. The Board have not yet discussed what tariff increases would be necessary, but the rise would not be steep, he said. The cost of bulk supplies was expected to rise by £1,220,000 a year, salary and wage increases would cost £995,000 and the net cost of the latest rise in coal prices would be £953,000 in a complete year. Profit would be reduced to about £1 million in the current year and, if tariffs were not increased, completely wiped out in 1961-62. Mr Lewis told the Council that the £2.8 million profit

netted in 1959-60 was not excessive on a turnover of £58 million. Revenue had supplied 57.5% of capital expenditure. "Some people may say that is too much," he added, "but we have undertaken as an industry to raise at least 48%."

An experiment in estimated meter readings was commented on favourably by Council members. A pilot scheme is in progress in rural parts of Shropshire and Herefordshire, where the meters of 22,000 consumers are being read in alternate quarters and estimated accounts sent out for the other two quarters. Meter reading and billing cost £1,175,000 last year, so there is scope for considerable savings if the plan wins the goodwill of consumers.

CHRISTMAS LIGHTS IN LONDON'S WEST END

Switched on last Thursday night, the lights include multi-coloured (and red) snowflakes above Oxford St (right)



ELECTROMATICS AT OVER 1,000 A WEEK!

PRODUCTION of "Electromatic" washing machines is now at a rate in excess of 1,000 a week—and they are being sold—it is revealed in a statement by Rolls Razor Ltd., who, under a contract in force until the end of 1965, have exclusive right to produce the machines at a profit of 10% on manufacturing cost. And between 1 Jan. and 30 June, 1961, Rolls have the option to acquire the capital of Electromatic Washing Machine Co.—the well-known direct-sales firm controlled by Mr J. Bloom—for a maximum of £100,000 to be satisfied by the issue of deferred shares. But Mr Bloom, who holds 44% of the three million Deferred 1s shares, continues as managing director at least until 31 Dec., 1965.

Appliance users default

LOSSES among hire-purchase houses have spread to a company operating mainly in the electrical appliance field. Charterhouse Credit Co. has stopped taking new business because of substantial bad debts. The parent company, Charterhouse Group, has decided to guarantee all commitments of Charterhouse Credit, which was known as Noble Lowndes Finance until Charterhouse Credit acquired a 65% interest in July, 1959. Heavy losses have been reported by several hire-purchase companies in recent months, but these were mainly due to bad debts on car business and frauds by dealers.

Stabilise credit—B.E.A.M.A. plea

PRESSURE on the Government to ease hire-purchase restrictions continues. Now the TUC have added their voice to that of manufacturers in asking the Chancellor of the Exchequer for relief, and the chief of BEAMA has made an emphatic plea for stable credit control. Speaking at the Norfolk Electrical Circle's annual dinner in Norwich last week, Mr Stanley Steward, director of BEAMA, said the minimum H.P. deposit should be immediately reduced to 10% and kept there. "We do not seek the abolition of credit control, but we consider it essential for the controls to be maintained at a stable level," he said. Otherwise, appliance manufacturers could not operate efficiently and exports would suffer.

H.P. "Black List"

SEVEN leading hire-purchase concerns—Bowmaker, British Wagon Co., Lombank, Mercantile Credit Co., North Central Wagon and Finance Co., Olds Discount Co. and Scottish Midland Guarantee Trust—are setting up a nationwide information service on individual credit ratings. They are acquiring Kemp's Mercantile Offices, publishers of *Kemp's Gazette*, which lists h.p. court actions.

Rolls Razor now anticipate a profit of £30,000 for 1960, based on trading for the first seven months and orders for washing machines since received by Electromatic. The company's Cricklewood factory has been re-equipped and revalued at £210,000. In order to ease a cash shortage the freehold will be sold and a 21-year lease taken.

Switchgear for Corby

SWITCHGEAR worth over £300,000 is to be provided by the General Electric Co. Ltd. for an outdoor substation of the CEBG at Corby, Northants. Increasing demand for electric power in the area, chiefly from a large steelworks, has necessitated an increase in the substation capacity. The plant to be supplied includes 13 132 kV, 3,500 MVA oil circuit-breakers, a 17-panel control board, relay panels, d.c. boards and outdoor isolators.

E.E. forms subsidiary in Portugal

ENGLISH Electric Co. has established a subsidiary in Portugal which will ensure the continuity of long-standing agency arrangements. Manager of the new company, *Electrica de Portugal*, is Mr R. I. Lewis, who has been EE's technical representative in Lisbon for several years.

Higher fees for trade marks

AS from 1 May next, the Board of Trade will charge higher fees for trade mark applications and registrations and also for renewals on and after that date. The existing rates have operated since 1955. It is proposed to raise the present fees of applications, registrations and renewals of £2, £3 and £5, respectively, to £4, £4 and £6.

TALKS ON CABLES

"RUBBER and Plastics in Cables" will be discussed by about ten speakers at the IEE headquarters in London on 1 March. Sir Christopher Hinton will speak on the problems of electricity transmission, and other talks in the provisional programme include Mr N. Parkman, of ERA, on the electrical properties of polymeric insulating materials, and Mr K. H. Whitlock, of Du Pont Co., on recent developments in the use of neoprene for wire and cable. The conference is being organised jointly by the Plastics Institute and the Institution of the Rubber Industry. These two institutes will hold another joint conference on "Education and Training in the Plastics Industry" at IEE headquarters on 19 and 20 June.

M-R go through Wholesalers

LIKE EMI, Morphy-Richards Ltd. will continue to use wholesalers for distribution of many of its appliances. Sir Joseph Lockwood, chairman of both companies since EMI took over Morphy-Richards, told distributors this at a recent luncheon.

CHATHAM BRIDGE CONVERSION

TWO 40-year-old bascule bridges at Chatham Dockyard have been converted from d.c. to a.c. operation by Crompton Parkinson Ltd. They span the narrow waterways between basins 1 and 2, and 2 and 3, and each with a span of 86½ ft are wide enough to take motor traffic, with a catwalk on each side. 7½ h.p., 710 r.p.m. t.e.f.c., w.p. a.c. slip-ring motors have been installed, one to each leaf. The bridges are subject to considerable wind pressure, and a lack of rigidity had in the past resulted in broken shafts on the d.c. motors. The new motors and their transmissions—new flexible couplings and electro-magnetic

brakes—have been mounted on special heavy bedplates which carry all the moving mechanism.

To provide full operation of each bridge on either side, a control cable has been installed in the tunnel, 100 ft beneath each bridge, which originally carried services from one side of the docks to the other. The leaves of the bridges are self-aligning, but if perfect alignment is not achieved, small adjustments can be made through inching buttons at the bridge centres. Murray Munro and Co. Ltd. were contractors for all mechanical and electrical work except running of conduit.

Motor, shipping coupling, magnetic brake with combined flexible coupling and gearing on the leaf of one bridge at Chatham Dockyard. Each leaf is operated by a 7½ h.p. slip-ring motor, and control of either bridge is from a single control house, with interlocking between bridge and boom gates



Lessons of Liverpool fire

Aspects of fire precaution practices at large stores were brought into focus by the fire at a Liverpool store, as statements at the inquest into the victims of the fire showed. Now the Secretary has asked the Fire Brigade Committee to look into these questions and a technical committee has been set up to consider them.

Space talk for children

The Christmas holiday lecture for this year will deal with British space events in space. Dr R. L. F. Boyd will talk on "Space research by rocket" at the IEE lecture theatre on Monday and repeat the talk on 4 January. The lecture begins at 3 p.m. on both days and admission is by ticket.

New I.C.I. Plastics Production Starts

Control plant of the new "Propathene" plant of Imperial Chemical Industries, at their Wilton Works, Middlesbrough



THE announcement last week by ICI that the new polypropylene plant at Wilton, with an annual production of 11,000 tons, is "on stream" heralds the arrival into general use of yet one more new material in the plastics range for general use. Propylene is the second in the range of olefins-hydrocarbons in which the

carbon and hydrogen molecules are in the proportion of 1:2—to be successfully polymerised. Ethylene, (C₂H₄), first polymerised 25 years ago by ICI into polythene at high temperatures and pressures, is now widely used both for electrical purposes and general usage, but its limitations lie in its limited rigidity and low softening point.

The new plastics is lighter than water, having a density of 0.9, and is as rigid as the harder p.v.c. plastics, but the rigidity is maintained up to 140°C to 150°C. It is resistant to practically all oils, fats, greases, acids and alkalis and the electrical properties, though not yet fully investigated, seem more than satisfactory.

The new material will be marketed by ICI under the name "Propathene."

RECENT PLANT ORDERS

Completion of a cable contract worth £10,000 for the USSR tyre factory at Togliatti has been completed by Crompton Parkinson Ltd. Over 100 miles of various types of cable have been supplied, all manufactured to BS specifications, in addition to Crompton switchgear and transformer equipment worth over £500,000. The factory order, worth some £150,000, was placed with Rustyfa Ltd., which Crompton Parkinson is a subsidiary of.

Power Paper Mills

Contracts valued at £330,000 for two generators to be installed at the new Paper Mills, Kent, have been awarded by the General Electric Co. to Albert E. Reed and Co. Ltd. The generators cover a 10 MW pass-out unit and a 7 MW back-pressure

unit set which will increase the total installed capacity to 52 MW—all GEC machines. The 7 MW set will be operated initially as a base-load topping unit, designed for steam conditions of 1,250 lb/sq in., 950°F. The 10 MW set will be supplied from the same steam range and will be fitted with a pressure-controlled pass-out for delivery of up to 180 klb/hr of process steam at 20 lb/sq in. The 11,000 sq ft surface condenser is to be made by Hick Hargreaves and Co., and Electroflo Meters Ltd. will supply a pressure- and temperature-reducing station.

... and abroad

AEI Motor and Control Gear Division have recently received contracts worth over £100,000 for equipment for the petroleum industry. One of these is from the Kuwait Oil Co. and includes seven flameproof squirrel-cage motors of 500 to 750 h.p.

That Division has also received a further order from British Cellophane for three sectional drives, and another worth £100,000 for equipment for a second pulp mill for the Caima Pulp Co. of Portugal, including power house plant, switchgear, control gear and various motors.

The GEC have obtained a £70,000 order for a winding engine for South Africa. Of the double-drum double-clutch type, with steel drums 10 ft dia by 4 ft wide, it will be driven by a single a.c. induction motor. Mechanical equipment will be made to GEC design by East Rand Engineering Co. in South Africa.

FRIGIDAIRE DEALER TAKEN OVER

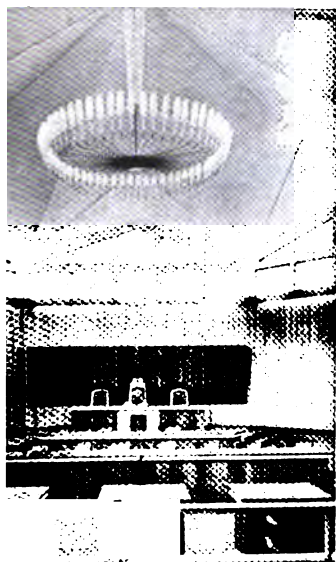
BRETT DANIELS LTD., large distributor for Frigidaire in North London, has been taken over by Southcros, a member of the Norcros group. In a deal worth £200,000, Southcros are allotting 36,000 5s Ordinary shares and 45,000 6½% £1 Preference, plus a cash payment of £46,000.

Flooding at Thornhill

EXTENSIVE flooding in the area put Thornhill power station, near Leeds, out of action last week-end. At 4 p.m. on Saturday, 26 Nov., the River Calder was 4 ft above normal, and pumps and condensers were quickly choked, necessitating shutting down the station (which had been generating 135 MW) at 7 p.m. With no signs of abatement, and with memories of the 1946 flooding, motors on low level were taken to high ground, and that night the river rose to 7½ ft above normal level. Water seeped through conduits and cable pipes and the pits of the five alternators were flooded. At 1 a.m. on Sunday, with slight improvement in the position, a start was made on putting the motors back, and at 10 a.m. the first machine (30 MW) began running to be followed by a 45 MW set at 5 p.m., and by Monday morning the station was operating normally, thanks to sterling work by employees of the Yorkshire Division, aided by the NFS and local fire brigade.

Heating Show in North

MANCHESTER is to have a home heating exhibition. The First Domestic Heating and Insulation-in-the-Home Exhibition is scheduled to be held at the Free Trade Hall from 19-22 Sept. Organisers are Clarke and Rhodes Ltd.



W lamps are used in this 9 ft dia., 8 ft high pendant in the new Council Chamber at Southern Rhodesia, supplied by General Electric Co., of England. It was made from standard "Variform" components and is the largest of its type so far

RAPID GROWTH IN GUERNSEY

A SWITCHBOARD made of Sicilian marble, framed in mahogany—that was the picture in Guernsey's first power-house when it was commissioned in 1900. But the price of a unit was 5·6d then against 2·4d now, the Bailiff of Guernsey, Mr W. H. Arnold, and members of the States of Deliberation were told when they visited St. Sampson's power-house recently to mark 60 years of electricity on the island. Growth has been at an even faster rate than on the mainland. The States of Guernsey Electricity Board have trebled sales in the past decade and expect output to rise from 37·8 million units this year, almost 2,700 units per consumer, to 43½ million in 1961. New administrative headquarters will be occupied during 1961-62.

RELIABILITY IN PROCESSING DATA

REALISTIC data and comparisons between the reliability of electrical and mechanical parts of data processing systems may become available from an informal discussion which the Institution of Mechanical Engineers is organising on 5 Jan. next. Under the title "The Reliability of Mechanical Engineering Parts of Data Processing Systems," the Institution expects the emphasis of the meeting to be placed on mechanical construction and reliability and on features of design and manufacture of particular importance to accurate and continuous operation. The meeting will take the whole day. In the morning there will be consideration of the present position and of the kinetics problems of high-speed mechanisms. In the afternoon and evening, consideration will be given to the production of electronic equipment. Forms for the meeting may be obtained from the secretary, I.Mech.E.

Saying^s OF THE WEEK

"The Chinese don't place orders. They negotiate. Then if they are still interested they make very firm inquiries." . . . MR H. BINYON, sales director, Solartron Electronics, on returning from a visit to Peking.

"And when I tell you that we had to co-ordinate no less than 37 different countries with contractors of seven different nationalities, you will readily understand that this widespread knowledge of the English language considerably eased our task." . . . MR G. F. KENNEDY, speaking on the Aswan Dam project at the Institute of Civil Engineers.

"In spite of the rising standard of living, continuous domestic heating is still regarded as a luxury. Cars, television, spin dryers and the like are regarded as near necessities." . . . MR R. M. LANG, in electric floor-warming symposium at Torquay.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Tuesday, November 29					
	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	231½	++	ZINC, virgin, min. 98% purity (cash) ...	87	-½
" (3 months) ...	228½	+½	" (3 months) ...	86½	-½
LEAD, refined pig. 99·97% purity (cash) ...	66½	-½	RUBBER, per lb No. 1, RSS, spot ...	25½d	—
" (3 months) ...	67½	-½	C.I.F. basis, ports. Feb. ...	25½d	+½d
TIN, refined, min. 99·75% purity (settlement) ...	799	-1	ARMOURING: Galv. Steel Wire (0·104 in.) ...	68	—
" (3 months) ...	797	—	Mild Steel Tape (0·04 × 1½ in.) ...	53*	—
ALUMINIUM, ingots 99·99·5% ...	186	—	NICKEL (home) ...	600	—
" wire bars (4 × 4 × 54") ...	193½	—	MERCURY (76 lb flask) ...	70½	—
BRASS Strip 63/37 ...	204½	+3½	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
SILVER (Troy oz) ...	79½d	—	Lead, (New York) ...	12c	—

* Tape Price, now an average, includes varnishing

E.P.E.A. DINNER

THAT the influence of the EPEA had penetrated even to the House of Commons was apparent, when a passage from the journal was quoted during the recent Electricity Bill, said Sir Robertson King, K.B.E., COMP. I.E.E., M.INST.F., when he proposed the toast to the Association. The occasion was the annual dinner held in the Connaught Rooms last Friday. Sir Robertson continued by referring to the success achieved by the Association in fulfilling the aims of its founders to establish better conditions for engineers. Commenting on the president's work for the Association in the East Midlands and in particular his connection with Staythorpe, where he is charge engineer, Sir Robertson recalled a protracted dispute when the station was under construction whether the sets should be aligned north and south or east and west.

In reply, the president, Mr H. Brockelsby, confirmed that the alignment was east and west and he wondered if the alternative would have raised the station's position in the league table. He thought the Association had now approached a turning point. In the

future it would no longer be concerned merely with working conditions, but would increasingly aim to promote a spirit of "get-togetherness" among the engineers in the ever-expanding supply industry. In conclusion he thanked the dinner organising secretary, Mr F. H. Smethurst, and referred to the enthusiasm of Mr George Essex, a founder member of the Association, who was shortly to retire.

News in Brief

Import duty on certain refrigeration-control parts and accessories is now refundable when re-exported, under a new Drawbacks Order by the Treasury.

The fifteenth annual examinations to be conducted under the ASEE Diploma Scheme will take place at various centres throughout Gt. Britain on 17-19 May, 1961.

465 guests attended the Midland Electrical Engineers' Association annual ball when Mr G. A. P. Lewis, president, announced that £150, proceeds of the previous ball, had been handed to the IEE Benevolent Fund.

Subject to the consent of the Department of Health, Ardrossan Town Council are to install under-floor electric heating in 18 houses to be built at Kilmahew St.

Son et Lumière floodlighting and recorded commentary may be applied to Stirling Castle.

The Private Members Bill to be based on recommendations of the Molony Committee on consumer protection is to have a second reading debate in the House of Commons on 27 Jan. The text of the Bill has not yet been published.

Nine posts of "Training Development Officer" under the industrial training council scheme for apprenticeship training have been created and five appointments have so far been made, says the Ministry of Labour.

Plans for setting up a research association to cover the machine-tool industry have reached the stage where a Director of Research is being sought and an application to DSIR for a grant is in preparation.

Cape Asbestos reorganises

THE Cape Asbestos Co. is forming three new subsidiaries as part of a plan to decentralise control of the group's activities. Cape Insulation and Asbestos Products Ltd. will take over the manufacture and sale of thermal insulation materials and the work of Contracts Division, from 1 Jan. Capasco will make and sell friction materials and plastics, and Cape Asbestos Fibres Ltd. will distribute fibres.

Radiotelephone Guide

A 12-PAGE booklet has been prepared by Automatic Telephone and Electric to explain briefly the principle and applications of v.h.f. radiotelephone equipment. After explaining briefly what v.h.f. radio telephone is, the booklet gives some elementary guidance on how to plan a scheme and to estimate its relative merits when compared with alternative methods.

Company Activities

GLOOM, gathers. Hire-purchase companies in difficulties, 18,000 on short-time at Ford's, refrigerator and electric cooker prices cut by GEC, the nation's stock of refrigerators now standing at around 500,000 units, friction over the engineers' wage claim—these were the latest and the biggest blows buffeting stock markets last week and were more than enough to precipitate public selling and professional "bear" selling. In one of the dreariest weeks for months, the *Financial Times* industrial ordinary index was lopped 11.3 points to 303.1.

There can be little doubt that the credit squeeze must now be at, or have passed through, the point at which it was intended to level back consumer spending, and without some easing very shortly its continuance will amount to no more than financial sadism. It is quite clearly the verdict of the market, however, that in the short run trading conditions for British industry will deteriorate before the cyclical improvement sets in. At the same time, longer term investors should now assume a vultural aspect on the likely prospect of many first class shares attaining new "lows" for the year. "In" and "out" of the market is fair enough game for the professionals but for John Citizen who is concerned with the growth of his free funds over the years, steady and selective equity investment is still the surest answer, and the time approaches when we shall read many times the word "bargain" in the financial columns of the Press.

In contrast to the advance of the previous week, electrical shares, too, had to sound the retreat. And here the "heavy brigade" was fast on the run. Again, reasons were not hard to find. GEC may have pleased the housewife with its announcement that it is cutting the prices of its refrigerators, but it certainly did not please the market. Moreover, the warning given by Mr E. Fowler, managing director of the GEC Domestic Equipment Group, to the effect that the

Government's restrictive measures in preventing large production runs may price GEC products out of both home and overseas markets did nothing to help matters. The reflection of that on the stock market was a 1s 9d tumble in the £1 Ordinary shares to 31s 9d—a new "low" for the year and on which a dividend yield of 6.3% is now offered. That, of course, assumes that last year's 10% dividend (1.9 times covered) is maintained in the current year.

English Electric's £1 Ordinary shares also dropped from 33s 9d to a new 1960 "low" of 31s 9d on which the yield is now 6.3%. And not to be left out of it, AEI, the biggest of Britain's electrical battalions, buckled back 2s 9d to a new 41s 9d "low" to show a yield of 7.2%.

Elsewhere, Decca Record dropped 2s to 52s, EMI came back a further 1s 3d to 42s 6d, E. K. Cole eased 2s 3d to 18s 7½, a 1960 "low," a feat also achieved by Pye with their 1s 9d drop to 12s 9d. After a rise of 3s to 53s BICC came back on profit-taking to 49s 9d, while Hoover "A" Ordinary, at one time inspired by their transatlantic tinge to touch 45s 9d, a rise of 3s, came back to finish the week at 42s 9d.

But the gloom was not altogether undiluted. Dimplex went up to touch a new peak of 49s 3d on strong demand, while the 5s Ordinary shares of Berry's Electric Magicoal warmed up 2s 9d to 51s 6d on the doubled interim of 13½%. There was also a statement here of a "satisfactory increase" in sales and profits for the half-year to 30 Sept., 1960, a one-for-three free scrip issue and a forecast to put the year's total dividend up to the equivalent of 40% against last year's 30%. As hire-purchase is not a major factor in the company's sales and as there is a buoyant export demand still for their products, Berry's is obviously one of the better bargains now offered on the electrical share market.—*From our City Correspondent.*

Ada (Halifax)

There is no interim dividend for the year to 31 March, 1961, the company (which is now controlled by Philips Electrical Industries) having made a loss estimated at £7,000 for the half-year to 30 Sept. The board does not anticipate an early end to the company's difficulties, in view of the unfavourable trading conditions.

Allied Ironfounders Ltd.

Announcing an unchanged interim dividend of 7½%, the directors add that the group profits to date are running at the same level as for the corresponding period of last year.

Berry's Electric Magicoal Ltd.

Another bonus issue is to be made, this time on a one-for-three basis. This

news is given by the directors along with an increase in the interim dividend for the year to 31 March last, 13½% as against 6½% last time, which is intended to even out the disparity between the interim and final dividends. With a satisfactory increase in sales and profits for the six months to 30 Sept. last, and in the absence of unforeseen difficulties, they forecast that the final dividend on the enlarged capital will not be less than 20%, to give the total equivalent for the year on the old capital of 40% compared with 30% for the previous year.

Crabtree Electrical Industries Ltd.

Record sales were achieved in the year ended 31 July last, but taxation negatives the result of the considerable

efforts, Mr J. A. Crabtree, the chairman, points out. The demand for the firm's products is increasing and the year ended with a substantial order book. Since the

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	356,157	116,102	31	20	29/3	22/3
1957	422,000	150,950	41	20	26/6	23/-
1958	323,387	112,572	30	20	33/9	24/4
1959	437,231	222,752	58	20	54/9	27/7
1960	537,536	206,063	27	16½*	39/9	23/-

* Plus 100% capital bonus.

end of the year work has started on projects involving capital commitments of a further £200,000 in the next 12 months. Extensions to the works at Walsall and Brownhills have begun, plus the erection of another factory at the latter site, and Mr Crabtree is confident of the future.

Dictograph Telephones Ltd.

At the end of August last there was a record volume of business in hand, and so far in the current year sales show no sign of diminution, Mr P. U. Summer, chairman, reports. Although anticipating a favourable report next year, he warns that rising labour costs may well affect profit margins and sales.

Southern Areas Electric Corpn.

Value of group orders received for 1960 to date is 60% in excess of that for 1959, Mr J. W. Milligan, managing director, stated last week prior to leaving on a USA tour to visit the group's associates. The experience of the individual subsidiaries varied considerably, and he warned that the market remains highly competitive while labour and other costs continue to rise.

Sun Electrical Co. Ltd.

The past year's results were a record, and the directors report that with the level of sales maintained for the first six months of the current year, they are hopeful that the trading results will once

Year to 30 Apr.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	165,458	64,590	110	25	43/6	34/-
1957	162,722	58,158	98	25	46/-	44/9
1958	152,438	55,058	93	25*	61/-	47/3
1959	139,140	54,014	41	15	17/3	8/3
1960	189,079	67,816	55	18½	17/10	15/-

* Plus 100% capital bonus.

again produce a satisfactory return. The increased level of sales would not have been possible if the improved branch premises, which have been provided during the past three years, had not been available. Looking further ahead, they have opened a sinking fund insurance policy with an annual premium of £1,505 to provide a substantial sum in the year 2035 when the leases of the head office premises expire.

Dividends Declared

Harland Engineering Co. Interim 4% (same).

Worthington-Simpson. Interim 10% (7½%).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

- 1 Dec.—Chesterfield B.C.** Supply of: (1) 88 25 ft tubular steel columns and one wall bracket; (2) 71 140 W sodium Group "A" lanterns; (3) 18 3 by 80 W fluorescent lanterns and 18 400 W colour-corrected mercury lanterns complete with lamps/gear; (4) 71 140 W sodium lamps/jackets/gear for A61 Exeter-Leeds Trunk Rd lighting.—Advertised 17 Nov. issue.
- 1 Dec.—East Kilbride.** Electrical work in erection of animal house and laboratory at Hairmyres Hospital. Applications to Secretary, Western Regional Hospital Board, 351 Sauchiehall St, Glasgow C.2, by above date.
- 2 Dec.—Renfrew C.C.** (2) Electrical work in the replacement of Greenock Academy. Applications to County Clerk, R. Urquhart, County Bldgs, by above date.
- 2 Dec.—Whitechurch U.D.C.** Installation of wiring and o/h tracks included in alterations to provide slaughter hall at public abattoir.—See 24 Nov. issue.
- 3 Dec.—Cambridgeshire C.C.** Supply, erection, wiring and fitting; (1a) nine 35 ft steel columns with 200 W sodium lighting at Caxton Gibbet roundabout (A45 and A14); (1b) eight 35 ft steel columns with 200 W sodium lamps at Four Went Ways roundabout (A11 and A604); (2) five 25 steel columns with 3 by 80 W fluorescent lamps at Bury Toll junction near Newmarket (A11 and A45).—Advertised 10 Nov. issue.
- 3 Dec.—Colwyn Bay B.C.** (Contract 1) Supply and installation of 99 Class "A" concrete columns and sodium lanterns; (2) supply of 480 Class "B" concrete columns; (3) supply of 480 60 W sodium lanterns/gear; (4) supply of 270 time switches; (5) erection and installation of 270 time switches; (6) cable duct laying; (7) removal of existing gas lamps.—See 24 Nov. issue.
- 3 Dec.—Hayton with Roby U.D.C.** Applications invited for inclusion in selected list for (Tender 12) public lighting equipment.—See 24 Nov. issue.
- 3 Dec.—Kingsbridge R.D.C.** Rewiring of Manor Hse. Council Clerk: J. H. Savidge.
- 3 Dec.—Swansea B.C.** Electrical installation in proposed primary school at Sketty Pk, Swansea.—See 24 Nov. issue.
- 3 Dec.—Tandragee U.D.C.** Fluorescent street lighting installation.—See 24 Nov. issue.
- 5 Dec.—Chilwell U.D.C.** (i) Supply of (a) 21 steel columns and (b) lanterns/lamps; (ii) erection and installation of 21 200 W sodium units for A11 No. 2 lighting scheme.—See 3 Nov. issue.
- 5 Dec.—Eccles B.C.** Electrical installations in: (1) 40 houses, New Hall Ave.; (2) four houses, Scott Ave.—See 24 Nov. issue.
- 5 Dec.—Liverpool.** Electrical supplies. Secretary, Garnet Chaplin, South Liverpool Hospital Management Committee, Sefton General Hospital, Liverpool 15.
- 5 Dec.—Manchester C.C.** Supply and installation of outside lighting of existing aeration plant at Davyhulme Sewage Wks.—Advertised 3 Nov. issue.
- 5 Dec.—Romford B.C.** Electrical installations in (1) Town Hall extension and (2) pavilions and parks depot, Central Park. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s each contract.
- 5 Dec.—Ross-on-Wye U.D.C.** Supply and erection of steel columns/brackets with 140 W sodium lanterns and ancillary work. Engineer and Surveyor, Council Offices, Broad St.
- 5 Dec.—York T.C.** Supply and erection of two 1,867 g.p.m. centrifugal pumps and gear for recirculation pumphouse at Naburn Sewage Purification Wks.—See 17 Nov. issue.
- 6 Dec.—Grimsby R.D.C.** Supply and erection of 14 25 ft concrete columns/lanterns/control gear along A16 Louth Rd, Waltham. Surveyor, 1 Deansgate Terr. Deposit £2 2s.
- 7 Dec.—Durham C.C.** (a) Electrical installations in Cleadon new County Junior School and Ryton Modern School extensions and adaptations. Electrical installations in standard police houses, Greenfield estate, Swalwell. County Architect, South St, Durham. Applications by above date.
- 7 Dec.—Evesham B.C.** Supply and installation of: (a) 33 30 ft tubular steel columns with 200 W sodium lighting along A435; (b) 20 existing columns converted to 200 W sodium along A433; (c) 41 25 ft tubular steel columns with 140 W sodium lamps/gear, along A44.—See 24 Nov. issue.
- 8 Dec.—Heston and Isleworth B.C.** Supply and erection of 41 Group "A" steel columns with mercury colour-corrected lamps/lanterns/gear and removal of 28 existing columns along Vicarage Farm Rd, Hounslow.—Advertised 24 Nov. issue.
- 8 Dec.—Irish Lighthouse Service.** Supply of lamps for year to 31 Dec., 1961. Irish Lights Office, Dublin.
- 8 Dec.—Swansea B.C.** Supply of one 3 kW d.c. generator.—See 17 Nov. issue.
- 10 Dec.—Bootle B.C.** Supply of (Item 13) cables and electrical goods and (Item 14) lamps for year from 1 April, 1961. Borough Surveyor, Town Hall.
- 10 Dec.—Cornwall C.C.** Applications invited for inclusion in approved list for (Item 17) electrical installations to County Architect, County Hall, Truro, by above date.
- 10 Dec.—Edinburgh C.C.** Supply and erection of five electrically operated overhead doors at Craigmillar Refuse Disposal Wks. Engineer and Manager, Lighting and Cleansing Dept., 329 High St.
- 10 Dec.—Northwich U.D.C.** Installation of power points in 50 pre-war houses. Engineer and Surveyor, Council Hse.
- 12 Dec.—Downpatrick R.D.C.** Electrical work in two blocks of four-storey maisonnettes and one block of three-storey single-person flats in Windmill St, Ballynahinch.—See 24 Nov. issue.
- 12 Dec.—Grimsby B.C.** (c) Electrical installation, on fixed-price basis, in remodelling South Parade Primary Junior School.—See 24 Nov. issue.
- 12 Dec.—Manchester C.C.** Supply and erection of passenger lift in City Courts and Juvenile Court.—See 24 Nov. issue.
- 12 Dec.—Roscommon C.C.** Supply and installation of 3-ph. motors, horizontal centrifugal pumps and water level indicator at Monksland, Athlone. Details from consulting engineers, 4 St. Francis St, Galway. Deposit £5 5s.
- 12 Dec.—Ryton U.D.C.** (5) Electric lighting and heating work in proposed eight single-person dwellings and three aged persons' bungalows. Surveyor, Council Offices, Ryton Tower.
- 12 Dec.—Stockport B.C.** 2. Electrical installation proposed Welfare Clinic, Longford Rd West, Reddish.—See 3 Nov. issue.
- 12 Dec.—West Hartlepool B.C.** Electrical installation in 16 old people's flats, Owton Manor estate.—See 24 Nov. issue.
- 13 Dec.—Kirkcaldy T.C.** (b) Electrical work in erection of new hall at Links St.—See 3 Nov. issue.
- 14 Dec.—Kingston upon Hall C.C.** Light and power installations in Adelaide County Primary School. City Architect. Deposit £2, payable to City Treasurer.
- 14 Dec.—Larne B.C.** Rewiring of 24 Arcon prefabricated bungalows, Edward Ave. Borough Surveyor, 8 Victoria Rd.
- 14 Dec.—Matlock U.D.C.** Supply and installation complete of nine sewage pumps at four pumping stations in Darley Vale.—See 6 Oct. issue.
- 14 Dec.—Waterford C.C.** Supply and erection of two 20 g.p.m. pumps and 380 V 3-ph. motors for Kill and Bonmahon water supply scheme.—See 17 Nov. issue.
- 15 Dec.—Stockport T.C.** Electrical installation in new dormitory wing and extension at "Reinbek," Aged Persons' Home, Bramhall La. Borough Architect, Town Hall.
- 16 Dec.—Maldstone B.C.** Electrical installation in conversion of 13 London Rd into an old people's hostel. Borough Engineer, Palace Ave.
- 16 Dec.—Sunderland B.C.** Electrical installation in Maternity and Child Welfare Clinic, Hylton Castle estate.—Advertised 24 Nov. issue.
- 16 Dec.—Wandsworth B.C.** (h) Supply of lamps; and (i) electrical works for year from 1 April, 1960.—See 24 Nov. issue.
- 17 Dec.—Birkenhead B.C.** Supply of lamps for year to 31 March, 1962. Manager, Works and Bldgs.
- 19 Dec.—Nottingham T.C.** Supply of (Item 1) lamps and accessories for schools, etc., for year from 1 April, 1961. Director of Education, W. G. Jackson, Exchange Bldgs.
- 19 Dec.—West Lothian C.C.** Supply and erection of 31 200 W sodium lanterns on 35 ft steel columns with 10 ft 6 in. outreach for A8/A89 Starlaw and A8/A899 Broxburn junctions lighting.—See 24 Nov. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an Index of trade information with over 100,000 entries

A Selection from the 108 queries answered this week

"Zenith" lampholders—agents for? A.E.—Walter Logan and Co. Ltd., 34 Oak Tree Dr, N.20.

"Winton" vacuum cleaners—address for? M.A.N.W.E.B.—Phoenix Sales Ltd., 11 St. Andrew St, E.C.4.

"Cinch" terminal blocks—makers of? O.L.—Carr Fastener Co. Ltd., Pinfold La, Stapleford, Nottingham.

"Eastwoods" towel rails—makers of? E.E.B.—Eastwoods Ltd., 158 City Rd, E.C.1.

"Johnson" wax polishers—makers of? S.W.E.B.—S. C. Johnson and Son Ltd., West Drayton, Middx.

"Elreco" time delay relays—makers of? T.E.—Electrical Remote Control Co. Ltd., Harlow New Town, Essex.

"Earlywarm" blankets—makers of? M.P.—Charles Early and Co. Ltd., Witney Mills, Oxfordshire.

Helimatic Ltd.—address for? E.T.—22 Buckingham Palace Rd, S.W.1.

"Radiopage" intercommunication systems—makers of? J.B.—British Communications Corp. Ltd., Exhibition Grounds, Wembley, Middx.

"Sirram" car kettles—suppliers of? P.P.L.—Hawker Marris Ltd., 34-54 Spencer St, Birmingham 18.

—**Southampton B.C.** (a) Electrical renovation at Millbrook Secondary School and (b) electrical installation at Glen Eyre Secondary Boys' School. Plans by Borough Architect, Civic by 5 Dec.

—**Fareham U.D.C.** Supply and installation of sewage pump, complete with motor control gear for Peel Common.—See issue.

—**Faling B.C.** Electrical installation at St. Ann's Secondary Girls' School, Springfield Rd., Borough Engineer, Faling, W.S. Deposit £1.—Advertised in issue.

—**Monaghan C.C.** (b) Erection and installation of two pumping sets to deliver m. at a 106 ft head for Rockcarry. Supply and/or erection of two 42 pumps at a 128 ft head for Newbliss, from consulting engineer, E. R. 1 Montpellier Terr., Galway. Deposit each contract.

—**Radcliffe B.C.** Supply and installation of 43 140 W sodium lamps on 25 ft poles and brackets, plus removal of 28 units along A667, Ringley Rd. Engineer and Surveyor, Town Hall.

—**Dumblane B.C.** Supply and erection of Group "A" concrete columns/auxiliary equipment, plus the removal of six columns along A9.—See 10 issue.

—**Oxford T.C.** Supply and erection of 3500 g.p.m. and two low-lift pumps complete with motors, gear and cabling.—See 10 Nov. issue.

—**Birmingham Tame and Rea.** Erection of electrically driven sewage distributors to distribute 11-6 and 34-8 m.g.d. over 64 acres. Drainage Board Engineer, Rookery, Birmingham 24.

—**Limerick T.C.** Supply of electrical laboratory equipment. Chief Engineer, Municipal Technical Institute, Limerick Ave.

—**N.I. Hospitals Authority.** Electrical engineering services installation in new wing for nurses at Ards Hospital, Belfast. 27 Adelaide St.

—**North of Scotland H.E.B.** Switchgear for Burghmuir substation, Perth.—Advertised 17 Nov. issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

7 Dec.—**Egypt.** Electrical supplies for refinery depots. Financial and Commercial Management, General Petroleum Authority, 44 Sh. Abdul Moneim, Dokki, Cairo. B.O.T. (ESB/30719/60).*

7 Dec.—**Rhodesia and Nyasaland.** Plastics insulated cables (two items), 35 tons h.d. bare copper wire. Town Clerk, P.O. Box 591, Bulawayo. B.O.T. (ESB/30046/60).*

8 Dec.—**Belgium.** Grey plastics sleeving and black plastics adhesive tape. Ministère de la Défense Nationale, Administration Générale du Budget, Direction Générale des Approvisionnements, Direction Supérieure des Achats de Matériel, Service d'Achat du Matériel Electrique, Quartier Prince Baudouin, Place Dailly, Bruxelles. B.O.T. (ESB/29477/60).*

13 Dec.—**America.** Two 250 kVA transformers. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center, Denver 25, Colorado. B.O.T. (ESB/30531/60).*

13 Dec.—**Canada.** 55 and 25 ton bridge cranes and a 16 ton gantry crane. Saskatchewan Power Corp., Regina. B.O.T. (ESB/30558/60).*

13 Dec.—**Singapore.** 2,000 vd 6-6 kV cable. City Council. B.O.T. (ESB/30588/60).*

14 Dec.—**Pakistan.** (1) 3,900 ft 1/0-44 12-core and (2) 8,700 ft 1/0-44 20-core 660 V p.i.s.w.a. metal-sheathed cable. Chief Controller of Stores, E.B. Railway, Pahartali, Chittagong. B.O.T. (ESB/30785/60).*

14 Dec.—**Rhodesia and Nyasaland.** Six 200 kVA 3-ph. transformers. Town Clerk, P.O. Box 591, Bulawayo. B.O.T. (ESB/30047/60).*

15 Dec.—**America.** Two duplex 7-2 kV metal-clad switchboard panels, bus structures, grounding equipment, water level telemetering equipment. Office of the District Engineer, U.S. Army Engineer District, 628 Pittock Block, Portland 5, Oregon. B.O.T. (ESB/30803/60).*

15 Dec.—**S. Africa.** Insulation test sets, phase sequence indicators, voltmeter, variable auto transformers, etc. Town Clerk, City Hall, Paul Kruger St, Pretoria. B.O.T. (ESB/30521/60).*

18 Dec.—**Kuwait.** 220,000 yd 1-1 kV under-

ground cable. Dept. of Electricity, Water and Gas, Kuwait. B.O.T. (ESB/30596/60).*

21 Dec.—**Burma.** (1) Cables and accessories; (2) three 500 kVA transformers; (3) i.t. distribution switchboards and switches; (4) lamps and fittings. Chairman, Board of Management for the Port of Rangoon, P.O. Box 1, Rangoon. B.O.T. (ESB/30016/60).*

21 Dec.—**India.** Cable, p.i.l.c.d.s.w.a., from 660 V to 11 kV, 14 items, and 19,000 ft p.i.l.c.s.w.a. 1-1 kV 4-core 0-0225 sq in. cable. Chief Purchase Officer, National Coal Development Corp. Ltd., 1 Council Hse St, Calcutta 1. B.O.T. (ESB/30502/60).*

21 Dec.—**Uruguay.** One million metres telephone cable and (closing date: 22 Dec.) 400 kg of 2 mm diameter solder. Administración General de las Usinas, Electricas y los Telefonos del Estado, Palacio de la Luz, Paraguay 2431, Montevideo. B.O.T. (ESB/30747/60D.L.F.).*

22 Dec.—**Pakistan.** 77,150 yd telephone cable. Mr F. Rizvi, Purchase Co-ordinating Officer, Block No. 32, P. and T. Directorate General, Karachi. B.O.T. (ESB/30454/60).*

22 Dec.—**Pakistan.** 400 V 3-ph. a.c. meters. Executive Engineer, Stores, Electricity, Bharat Bldg, Lahore. B.O.T. (ESB/30834/60).*

22 Dec.—**Rhodesia and Nyasaland.** 11 kV distribution transformers. Secretary, Southern Rhodesia Electricity Supply Commission, P.O. Box 377, Salisbury. B.O.T. (ESB/30776/60).*

27 Dec.—**Pakistan.** Cable, 21 items. Mr F. Rizvi, Purchase Co-ordinating Officer, Block No. 32, Posts and Telegraphs Directorate General, Karachi. B.O.T. (ESB/30455/60).*

3 Jan.—**Argentina.** 1,100 nickel iron accumulators and 600 special accumulator blocks, etc. Oficina de Licitaciones, Secretaria de Transporte, Empresa Ferrocarriles del Estado Argentino, Superintendencia de Compras y Almacenes, Avda. 389 5° Piso, Buenos Aires. B.O.T. (ESB/30501/60).*

3 Jan.—**Iran.** One 200 kW and two 150 W diesel generating sets. Iranian Sugar Factories Co., Teheran. B.O.T. (ESB/30712/60).*

9 Jan.—**Sudan.** 120 weatherproof 140 W h.p.m.v. floodlights. Office of Controller of Stores, Sudan Railways, Atbara. B.O.T. (ESB/30851/60).*

10 Jan.—**Sudan.** Underground cables. Controller of Stores and Workshops, Posts and Telegraphs Dept., Light Industrial Area, Khartoum. B.O.T. (ESB/30710/60).*

19 Jan.—**Australia.** Insulation and resistance testers: 15 items. Controller, Postmaster-General's Dept., 114 Russell St, Melbourne. B.O.T. (ESB/30759/60).*

5 Feb.—**Kuwait.** 33 kV steel tower transmission lines, Khalidiyah to Sulaiyiyah substations and Sulaiyiyah to Jahara Village. 33 kV metal-clad switchboards and remote control boards for Sulaiyiyah and Jahara substations. Dept. of Electricity, Water and Gas. B.O.T. (ESB/30597 and 8/60).*

15 Feb.—**Portuguese East Africa.** Twelve cranes for Beira Port. Ports, Railways and Transport Dept., Lourenco Marques. B.O.T. (ESB/30543/60).*

28 Feb.—**India.** Switching and booster transformer station equipment for 25 kV 50 c/s railway scheme on Sealdah-Ranaghat and Dum Dum-Bongaon sections on Eastern Railway. General Manager and Chief Engineer, Railway Electrification, 235 Lower Circular Rd, Calcutta 20. B.O.T. (ESB/30717/60).*

CONTRACTS PLACED

—**Widre C.C.** Supply and erection of 28 steel columns with 200 W lanterns/gear leys and Woodstock Rd roundabouts, Southern and Western By-pass, Municipal Ltd.

—**Ham-on-Sea U.D.C.** Supply of 22 lanterns, lamps and gear, Atlas & Ltd., £242; supply, erection and of columns. Engineering and Lighting cent Co., £1,584.

—**Widre Port B.C.** Provision and erection of group "A" lighting units, plus resiting of group "B" units along various roads, Ring and Lighting Equipment Co.

—**C.C.** Supply and erection of 35 ft columns with 200 W lanterns and gear A224, Halstead Roundabout, Abacus Ltd.

—**Widre Hall C.C.** Electrical installation in 157 dwellings, Boothferry estate, Electrical Co.

—**Widre C.C.** Electrical work at: Alpha Sq, Muel Reed and Sons, £5,788; Ashfield area, Electrical Contracting Co., St. Helier estate, F. J. Baynes and L., £5,653 and £9,064.

—**Widre T.C.** Supply and erection of 31 "B" steel columns complete with lanterns on Oak Tree estate, Municipal Ltd.

—**Widre upon Tyne C.C.** Supply and erection of telephone system in new

Town Hall, Barras Bridge, Associated Electrical Industries Ltd., £24,470.

—**Pelton P.C.** Supply and erection of 30 concrete columns, lanterns and lamps on Vicarage housing estate, B. L. Oliver.

—**Seaton Valley U.D.C.** Supply and erection of 327 street lighting units and supply only of 132 units, Concrete Utilities Ltd. Recommended.

—**Stockport B.C.** Electrical installation renewal at Alexandra Pk Primary School, F. Mather and Co, £2,498.

—**Watford B.C.** Street lighting North Orbital Rd, Midland Lighting and Bldg Ltd., £3,549. Recommended.

TRADE NOTES

Change of Name. The Electric Resistance Furnace Co. Ltd. changes its name to Efco Furnaces Ltd. as from 1 Dec.

Expansion. Stearn Electric Co. Ltd. have expanded three branches. At Daleside Rd, Nottingham, a new two-storey block has been occupied; at Preston, the company have moved into Magnet Hse, in Derby St, previously occupied by the G.E.C.; and at Monks Rd, Lincoln, two adjacent premises have been acquired.

Manchester Depot. Charles Churchill and Co. Ltd. have opened new branch show-

rooms, offices and warehouse at 2-12 The Crescent, Salford, Manchester 5. Telephone: Pendleton 1382.

S.A. Imports. The South African Board of Trade is considering an application for the increase of duty on imported electric light galleries from free and 15% *ad valorem*, to 15% and 20%, respectively.

New Factory. L. E. Simmonds Ltd. will add 6,000 sq ft to their manufacturing capacity when they take over, at the end of November, the new factory at Theford. Company H.Q. remains at Byron Rd, Harrow.

BUSINESS PROSPECTS

Abingdon B.C. Tender: 35 flats, Vineyard. Architects: D. Page and Ptnrs, 28 Beaumont St, Oxford.

Alnwick. Remodelling of Duke's Grammar School planned by Northumberland C.C.

Atcham R.D.C. Tender: 19 bungalows and warden's house on each of Bayston Hill and Cross Houses housing sites. Engineer.

Bacup. Robert Wood and Sons, Lee Mill, Bacup, plan new Stacksteads factory.

Banstead U.D.C. Tender: 243 dwellings, Chapel Way area, Tadworth. Clerk.

Barnsley B.C. £2,750 scheme for modernising lifts at Town Hall.

Bathavon R.D.C. Tender: Eight houses, two-storey block of eight flats and warden's house, Combe Down, Bath. Architect.

Bedlington and Wallington B.C. Street lighting programme for lighting of 13 streets.

Belfast. Behr-Manning, Castlereagh Rd, plan factory extensions.

Biggleswade U.D.C. Tender: Section "A," 27 houses; and Section "B," 22 houses at London Rd housing site. Engineer.

Birmingham T.C. Tenders: Contract 700, eight two-storey dwellings, Starbank Rd, Hay Mills; Contract 709, 27 four-storey dwellings, Tessall La, Egghill La estate, Northfield; Contract 711, three shops, etc., Millpool Hill estate, Warstock; and Contract 742, 12 four-storey dwellings and shop, Deelands Rd, Rubery. Architect.—Contract 749, four children's homes and 15 two-storey dwellings' sites, Bartley Green and West Heath. Architect.—Welfare Committee plans multi-storey Handworth home.

Bolton. Corporation plans psycho-geriatric patients' hostel, Chorley New Rd.

Bootle B.C. Improved traffic signals planned at Balliol Rd/Hawthorne Rd and junction Stanley Rd/Merton Rd.

Bradford. Quadrex Nominees, W.1, promoters of £5 million development in city.

Brighouse. Smith Bulmer and Co. plan Branhholme Mills, Bailiff Bridge, factory extensions.

Burton-on-Trent. Health Committee plans residential home for 50 aged persons, Albury Hse site, Stapenhill Rd.

Caernarvonshire. R. Colwyn Foulkes, Merton Pl, Pwllcrochan Ave, Colwyn Bay, architect for £1 million improvements at Oakwood Park Hospital, Conway, for Welsh Hospital Board, Cardiff.

Canterbury. War Department plans £350,000 rebuilding of Hower Barracks.

Cardiff. Wm. Cowlin and Son, Penarth Rd, contractors for £200,000 building extensions at Royal Ordnance Factory for M. of Works.

Chelmsford R.D.C. Tender: Six bungalows and ten houses, Little Baddow. Housing and Estates Manager.

Chippenham. Wiltshire C.C. plans Marshfield Rd training centre and mental health hostel.

Consett. U.D.C. plans development of 70-acre Delves site as industrial estate.

Croydon. I.T.A., 14 Princes Gate, S.W.7, plan enlarged TV station with 500 ft tower at Beaulieu Heights, South Norwood Hill, S.E.

Cuckfield U.D.C. Tender: 60 houses, Ashenground Wood, Haywards Heath. Surveyor.

Dundee T.C. Tender: three houses, Dean Ave housing estate. Quantity Surveyor.

Durham. Clayton and Deas, High Row Chmbrs, Darlington, architects for junior and infants' school, Leasingthorne, for C.C.—Sir Basil Spence, 40 Moray Pl, Edinburgh, architect for £400,000 new women's college, St. Aidan's, New Elvet Hill, Durham City, for the University.

Enfield. Thorn Electrical Industries Ltd., Upper St. Martin's La, W.C.2, plan single-storey laboratory building, Southbury Rd, and canteen at Gt. Cambridge Rd.

E. Sussex C.C. Welfare Services Committee, Lewes, plans following old people's homes: Court Farm, Hove, 60 places; Lewes, 50 places; senior hostels at Mid-Sussex area, ten places, and S.W. coastal area, ten places; Mid-Sussex area, 50 places.

Frinton and Walton U.D.C. Scheme for lighting improvements in Frinton, £10,700.

Gateshead. Hadden and Hillman, Heaton Rd, Newcastle, plan 500 houses and shops at Chowdene Hall Farm.

Glasgow. Scottish Co-operative Wholesale Society, 95 Morrison St, C.5, plan seven-storey bank and drapery warehouse.—Western Hospital Board, 46 West Regent St, C.2, plan children's unit at Stobhill General Hospital.

Godalming B.C. Tender: 21 bungalows in terraces, Green La, Farncombe. Engineer.

Hedham. J. T. Bell and Sons, Market St Chmbrs, Newcastle, plan housing developments at Tynedale Gdns, Stocksfield.

Herne Bay U.D.C. Tender: 30 to 36 dwellings, rear Sussex Gdns. Architect: J. C. Clague, Lloyds Bank Chmbrs, High St.

Hexham. R.C. school planned for Northumberland C.C. Architect.

Hinckley. Amoa Chemical Co. plan extensions of their premises.

Houghton-le-Spring. Newrick and Blackbell, 58 John St, Sunderland, architects for 34 houses at Warden Grove for Isaac Berriman.

Hursley. I.B.M. Laboratories, W.1, plan factory block on site at Hursley Hse.

Ilford. Sir Robert Tasker and Ptnrs, 3 Field Court, Gray's Inn, W.C.1, architects for Commercial and Industrial Structures' workshop and offices, Woodford Ave.

Ipswich. E. Anglian Hospital Board, Cambridge, plan £125,000 boiler house, etc., Ipswich and East Suffolk Hospital.

Isle of Wight R.D.C. Tenders: (a) Two bungalows, Thorley St; and (b) two bungalows, Newchurch School.

Jarrow. Industrial Estate Management Corporation for England, Team Valley Estate, Gateshead, plan 40,000 sq ft factory on Simonside estate.

Kettering. Gollins, Melvin Ward and Ptnrs, 15 Manchester Sq, W.1, architects for £800,000 extensions to General Hospital.

Kidderminster R.D.C. Tender: 32 dwellings, Cookley, and 22 dwellings, Chaddesley Corbett. Architects: A. T. Butler and Ptnrs, 31 Priory St, Dudley.

Kiveton R.D.C. Tender: 56 houses, Red Hill site. Architect: B. D. Thompson, 102 Bridge St, Worksop.

Lisburn R.D.C. Tender: 36 dwellings on three sites at Finaghy, Belfast. Architect: H. McMordie, 29 Wellington Pl, Belfast 1.

Liverpool. Regional Hospital Board plans extensions to X-ray department at St. Helen's and extensions, etc., to operating theatre at Clatterbridge Hospital.

London. Kenneth Castiglione, 15 Colindale Ave, plan laboratory.—P. G. S. Fox, "Wyldes," North End, N.W.3, architect for Neuberger Products' factory extensions, Rookery Way.—H. Bramhill, 10 Gray's Inn Sq, W.C.1, architect for cold store and ancillary accommodation at 25 Wapping High St, E.1.—Stanley Peach and Ptnrs, 28 Eccleston Sq, S.W.1, architects for Saffron Hill/Kirkby St junction industrial building.—L. R. Bovingdon, 2 Yew Tree Rd, W.12, architect for Coronation Rd, N.W.10, factory planned by Fargo Properties.—C. W. Lowe, 7 St. Thomas St, S.E.1, architect for rebuilding of Bedford Steer End and Co.'s factory, Long La, S.E.1.—Hastie, Winch and Kelly, 1 Bentinck St, W.1, architects for £175,000 building extension in Croft St, S.E.8, for J. and H. Transport Services (Peckham).—Elliott, Cox and Ptnrs, 172 Buckingham Palace Rd, S.W.1, architects for A. Cohen and Co.'s extensions at Woolwich Arsenal Industrial estate, S.E.18.—L. A. Culliford and Ptnrs, architects, and Humphreys Ltd., Knightsbridge, S.W., are connected with *Daily Telegraph's* plan for extensions bounded by Little New St, New St Hill, Wine Office Court and Printer St.—Munbv. Smith and Hampton, 46a King's Rd, S.W.3, architects for A. Gallenkamp and Co.'s Christopher St offices.

Londonderry. T.C. approved scheme for 500 houses.

Lowestoft B.C. Scheme planned for lighting Denes Oval buildings.—Birds Eye Foods Ltd., Hesketh Hse, Portman Sq, W.1, plan fish and poultry by-products plant on site at Wildes St for their associate company, Ocean Harvest.

Maldstone. Extensions to 1960-61 street lighting programme planned at £5,090, and further programme for improvements during 1961-62 at £18,010.—Wallis Gilbert and Ptnrs, 5 Cromwell Rd, S.W.7, architects for Alabaster Passmore and Sons' extensions.

Manchester T.C. Tender: 60 dwellings, Hazel Grove and Bramhall. Director of Housing.

Mansfield B.C. Tender: 25 dwellings, Crow Hill site. Documents from E. T. Crowe, Carr Bank, Mansfield.

Middlesbrough. P. R. Middleton and Ptnrs, 111 Albert Rd, architects for building developments in Linthorpe Rd for Blue Line Cars (Middlesbrough) Ltd.—Kitching and Co., 21 Albert Rd, architects for rebuilding and development of Devonport Hotel for J. Eadie Ltd.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Allied. B798,210. Class 7. Scrubbing, washing machines, etc. B798,211. Class 9. Apparatus, etc. Allied Ironfounders Ltd., 28 Brook St, W.1.

Autronic. 775,625. Class 9. Control switches incorporating automatically operated safety releasing devices. Autronic Developments Ltd., Crawley Rd, Newport Pagnell, Bucks.

Elgastat. 805,777. Class 9. Apparatus, etc. Elga Products Ltd., Lane End, Bucks.

Gus. Classes 7, 8, 9 and 11. Great Universal Stores Ltd., Devonshire St, Ardwick, Manchester.

Isoval. 800,783. Class 9. Apparatus, etc. Etablissements Merlin and Gevin, Rue Henri Tarze, Grenoble, France.

Kismatic. 807,042 and 3. Classes 7 and 8. Paint spraying apparatus, etc. Wm. Turner (Kismet) Ltd., Fenlake Wks, Fenlake Rd, Bedford.

Polyclad. B807,786. Class 9. Flexibles, wires, cables, etc. Concordia Electric Wire and Cable Co. Ltd., Trent Mills, Derwent St, Long Eaton, Nottingham.

Proxar. 737,007. Class 9. Apparatus, etc. Carl-Zeiss-Stiftung, Heidenheim an der Brenz, Württemberg, Germany.

Recomp. 807,023. Class 9. Computers, etc. North American Aviation Inc., International Airport, Los Angeles, U.S.A.

Remington. 788,892. Class 8. Shaving instruments, etc. Remington Rand Ltd., Commonwealth Hse, 1-19 New Oxford St, W.C.1.

Storador. 797,895. Class 11. Refrigerators, etc. Ada (Halifax) Ltd., West Mount Wks, Johnson St, Halifax.

Tom Thumb Candles. 806,594. Class 11. Lamps simulating candle flames, etc. A.E.L. Lamo and Lighting Co. Ltd., 33 Grosvenor Pl, S.W.1.

Tweeny Jet Waste. 795,294. Class 7. Machines for pulverising, nulp'ng, etc. High Eng. Ltd., Ross-on-Wye, Hereford.

Prospects—Continued

Mr. Barrett Sons and Ptnrs, 33 ge, quantity surveyors for Regional Board's radiotherapy centre at Hospital.—£142,979 development rudohe and Monkton Hospital for Hospital Board.

Development Corporation ten-two-storey houses on Chapel Hill g scheme. General Manager.

Mr. Northern Ireland Housing ler: 412 dwellings at Redmanville

extension of Portadown. Offices of the Trust, 12 Hope St, Belfast.

Rotherham. B.T. Commission plans light industrial premises in Masborough area.

Rothwell U.D.C. Tender: Three blocks of four two-bedroom flats, Harrington Rd site. Surveyor.

ShIPLEY U.D.C. Tender: Rochester St redevelopment, including 42 one-bedroom and 21 two-bedroom flats and bungalows. Surveyor.

Southwell R.D.C. Tender: 16 pairs dwell-

ings and communal block at Crowpark Ave, Sutton-on-Trent. Architect.

Spennymoor. Durham Coal Board (No. 4 Area), Coundon, plan £100,000 offices covering 40,000 sq ft at Green La. Divisional Architect's Dept., 24 The Side, Newcastle.

Swansea B.C. Electrical installation planned at proposed primary school, Sketty Park. Architect.

S. Wales. Forth Chemicals Ltd., Bo'ness Rd, Grangemouth, Stirlingshire, plan £3 million plastics plant on site between Neath and Port Talbot.

Swinton. Manchester Hospital Board plans extensions to Royal Manchester Children's Hospital.

Taunton. H. S. W. Stone and Ptnrs, 20 The Crescent, architects for industrial site in Priorswood area for T. S. Penny (Property Development).

Tynemouth B.C. Scheme for automatic traffic signals at junction of Wallsend Rd and Station Rd, Percy Main.—Redevelopment scheme for shops and maisonnettes, etc., Front St, Cullercoats, planned. Engineer.

Wakefield. C.C.P. Holdings Ltd. plan development of Corporation's Kirkgate site.

Wallasey. Borough Architect to prepare plans for health clinic, Twickenham Drive.

Wednesbury. Clifford Products plan Brookside factory extensions.

Winchester T.C. Tender: Eight dwellings and a shop in Canon St. Quantity surveyors: A. S. Wilson and Ptnrs, 8 Storey's Gate, London, S.W.1.—Pink and Arnold, Westgate Chmbrs, Winchester, surveyors for Southern Counties Agricultural Trading Society's new offices.

GAZETTE ANNOUNCEMENTS**COMPANIES ACTS**

as of Putney Ltd. Mr B. Rose, 1 Victoria St, E.C.4, appointed at extraordinary general meeting iv. for the purpose of voluntarily p.

Electric Co. Ltd. Mr B. Rose, 1 Victoria St, E.C.4, appointed at extraordinary general meeting iv. for the purpose of voluntarily p.

Electrical and Radio Co. Ltd. ip order dated 14 Nov. Electra- Mr R. A. Hawken, Bank Chmbrs, t, W.C.1, appointed liquidator at ary general meeting on 15 Nov. urpose of voluntarily winding-up.

Electrics Ltd. Mr B. Goodwin, 111 E.C.2, appointed liquidator at ary general meeting on 14 Nov.

ndustries Ltd. Meeting of creditors ld at Room 47, Winchester Hse, 1 St, E.C.2, on 9 Dec., at 10 a.m. d Ltd. Last day for receiving r intended dividend: 7 Dec., to : F. M. Collins, Inveresk Hse, d, W.C.2.

Domestic Appliances (Cardiff) Ltd. ings of creditors and contributories ld at Official Receiver's Office, outh Bldgs, Westgate St, Cardiff, on t 3.15 and 3.45 p.m., respectively.

ps Dissolved

Wharfedale. Partnership between D. G. Roe, electrical contractors, n business as Roe Bros., at Otley y-in-Wharfedale, dissolved as from ll debts to be paid by D. G. Roe, View Ave, Burley-in-Wharfedale, rrying on the business.

um. Partnership between J. R. d K. C. Shallcross, radio, telel electrical engineers, carrying on is Merstham Radio and Television at 54 Nutfield Rd, dissolved as iept. Debts to be paid by K. C. , who is carrying on the business.

BANKRUPTCY ACTS**Orders**

ams. W. E. Thomas and R. C. etrical appliance dealers, formerly n business as Home Valet Service, ph St, Hemel Hempstead, and as ppliance Specialists and Home Electrical Services, at 15a High Hempstead, Receiving order dated

I. F. C. Turner, domestic appliance etrical and motor engineer, for- rying on business as Ross Electrics, z, and as Eros Security, at 112 Gate, 14 Bentinck St, 28 Spring- Balby, 18 South Parade and Cherry heate, all at Doncaster; and at e Rd and 127 Spring Bank, Hull, n St, Huddersfield, and at 9 Eldon is 1. Receiving order dated 21 Nov.

ster. E. Humphreys, electrical partner in the firm, J. and H. of 8 Benchill Ave, Benchill, awe, lately carrying on business 8 Rochdale Rd, Harpurhey, Man- Receiving order dated 17 Nov.

ring and Public Examination

ma. F. J. B. Pink, electrical and ion engineer, lately carrying on

business as Reliance Refrigeration Service Co., at Sherwood Wks, Sherwood Rd, Bognor. First meeting: 11 a.m., 1 Dec., at Official Receiver's Office, 8 Old Steine, Brighton; and public examination: 10.30 a.m., 27 Jan., at Court Hse, Church St, Brighton 1.

Appointment of Trustee

York. M. W. P. Walsh, electrical goods dealer, formerly carrying on business at 59 Holgate Rd. Mr R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, appointed trustee as from 17 Nov.

Intended Dividend

GL. Yarmouth. P. E. Pitchers, radio and electrical engineer, formerly carrying on business at 13 Tann La, Caister-on-Sea. Last day for receiving proofs for intended dividend: 2 Dec., to trustee: C. A. Taylor, Norfolk Hse, Exchange St, Norwich.

MEETINGS TO NOTE**THURSDAY, 1 DEC.**

I.E.E. "Our Civic Lighting: Gloom or Gaety?" W. R. Stevens and H. M. Ferguson; and "A Survey of Street Lighting and its Future," W. R. Stevens and H. M. Ferguson. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Southern). "Instrumentation of Nuclear Reactors." D. Harrison. South Dorset Technical College, Weymouth. 6.30 p.m.

I.E.E. (Hull). "Marine Electrical Practice on Cargo Liners." D. G. Robinson. Joint meeting with Graduate and Student Section, Lecture Theatre. Y.E.B. Offices, Ferensway, Hull. 6.30 p.m.

CHELMSFORD ENGINEERING SOCIETY. "The Raising of H.M. Submarine *Truculent*." Lt-Cdr L. Hackman. Hoffmann's Social Hall. 7.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Education Group). "Is Training in Industry Really Integrated with Academic Studies on Sandwich Courses in Colleges of Technology?" Birdcage Walk, S.W.1. 6 p.m.

I.E.S. (Nottingham). "The Eye and Artificial Lighting." W. J. Wellwood Ferguson. Electricity Centre, Carrington St. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N. Western). "Industrial Television." I. M. Waters. Reynolds Hall. College of Technology, Manchester. 7 p.m.

BRITISH INSTITUTE OF MANAGEMENT. Conference: "The Importance of Engineering Services to Modern Management." Connaught Rooms, Gt. Queen St. W.C.2.

A.S.E.E. (Brighton, Hove and District). "Stage Lighting Presentation." F. E. Brown. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

A.S.E.E. (Oxford and District). "Circuit and Equipment Applications of Transistors." Cockcroft Hall, Harwell. 5.45 p.m.

FRIDAY, 2 DEC.

I.F.E. (Medical Electronics Group). Discussion: "Telemetry Biological Data." Savoy Pl, W.C.2. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "Selection Design and Application of Automatic Control Valves." P. Stone. Admin. Bldg, Esso Refinery. 5.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Computer Group). "Progress in Microminiature Circuit Techniques for Digital Computers." D. Roberts, D. S. Campbell and P. M. Thompson. London School of Hygiene and Tropical Medicine, Keppel St. W.C.1. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (S. Midlands). "The Place of the Electric Rocket in Space Propulsion." W. A. S. Murray. North

Gloucestershire Technical College, Cheltenham. 7 p.m.

PLASTICS INSTITUTE (N. West). "Hot Runner Moulds." W. G. Lucas. Textile Institute, 10 Blackfriars St, Manchester 3. 6.45 p.m.

A.S.E.E. (Liverpool and District). "An Approach to the Use of Electrical Units." D. Chalmers. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "Variable Speed A.C. Motors." J. C. H. Bone. Royal Hotel, Crewe. 7.30 p.m.

MONDAY, 5 DEC.

I.E.E. Discussion: "National Proving of Domestic Electrical Equipment." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). "The Determination of the Electrical Characteristics of an Arc Furnace." J. Ravencroft. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (S. Midlands). "Parametric Amplifiers." R. V. R. Carter and I. A. Bagnall. Winter Gardens, Gt. Malvern. 7.30 p.m.

I.E.E. (S. Midlands). "Radio-communication in the Power Industry." E. H. Cox and R. E. Martin. College of Technology, Birmingham. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics). Lecture: "Radar Observations of Birds and 'Angels'." E. Eastwood. Rutherford College of Technology, Newcastle. 6.15 p.m.

I.E.E. (Maidstone). "Uses and Manufacture of M.I.C.C. Cable." G. E. D. Redman. Maidstone Technical College. 7 p.m.

N.E. ELECTRICAL CIUM. "Looking at Lighting." A. Wilcock. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. York-shire). "Instrumentation for Railway Research." P. H. Mansfield. University, St. George's Sq, Sheffield 1. 7 p.m.

I.E.S. (Leeds). Members' Night. Lighting installations by members of the Centre. British Lighting Council. 24 Aire St. 6.15 p.m.

I.E.S. (Newcastle). "Looking at Lighting." A. Wilcock. County Hotel. 6.30 p.m.

A.S.E.E. (Bolton). "Railway Electrification." Railway Hotel, Trinity St. 7.45 p.m.

A.S.E.E. (Exeter). "Disregard of the I.E.E. Regulations." E. J. Sutton and H. C. Breeze. Angel Hotel, Ilford Broadway. 8.15 p.m.

A.S.E.E. (Leeds). "Lamps and Lighting." K. Haylor. Gt. Northern Hotel. 7.30 p.m.

A.S.E.E. (Sheffield). "Application of Electrical Control: Oil and Gas Burners." D. Stretton-Smith. Royal Victoria Hotel. 7.30 p.m.

Meetings to Note—continued TUESDAY, 6 DEC.

I.E.E. (Measurement and Control Section). "A Universal Non-Linear Filter, Predictor and Simulator, which Optimises Itself by a Learning Process," Professor D. Gabor, W. P. L. Wilby and R. Woodcock. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Southern). "F.M./A.M. V.H.F. Portable Transistor Receivers," L. E. Jansson. The University, Southampton. 6.30 p.m.

I.E.E. (N. Midlands). "Thermistors—Their Theory, Manufacture and Application," R. W. A. Scarr and R. A. Setterington. Bradford Institute of Technology. 6.30 p.m.

I.E.E. (N.W. Utilisation Group). "Electrical Characteristics of the Argon Arc Welding Process," J. C. Needham and L. H. Orton. Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (E. Anglia). "Engineering Aspects of Commercial Television Programme Presentation," T. C. Macnamara. Stuart Hall, Norwich. 7.30 p.m.

I.E.E. (Auto Graduates and Students). "Automatic Electric Lifts," K. A. Yeomans and R. J. Bedford. Northampton meeting.

INSTITUTION OF PRODUCTION ENGINEERS (Southern). "Non-Destructive Testing as an Aid to Production," D. G. W. Claydon. Town Hall, Oxford. 7.30 p.m.

A.S.E.E. (W. London). "Railway Signalling," G. R. Kent. Windsor Castle Hotel, 134 King St, W.6. 7.45 p.m.

A.S.E.E. (Reading and Districts). "Fire Protection," Marquis of Lorne, Friar St. 7.30 p.m.

WEDNESDAY, 7 DEC.

I.E.E. (Southern). "Radiocommunication in the Power Industry," E. H. Cox and R. E. Martin. South Eastern Electricity Board Office, 10 Queen's Gardens, Hove. 6.30 p.m.

I.E.E. (N.W. Electronics and Communications Group). Discussion: "New Semiconductor Devices," Engineers' Club, Manchester. 6.15 p.m.

I.E.E. (Tees-side). "The Logmotor—A Cylindrical Brushless Variable-Speed Induction Motor," Prof F. C. Williams, E. R. Laithwaite, J. F. Eastham and L. S. Piggott; and "Brushless Variable-Speed Induction Motors Using Phase-Shift Control," Prof F. C. Williams, E. R. Laithwaite, J. F. Eastham and W. Farrer. Cleveland Scientific and Technical Institution, Middlesbrough. 6.30 p.m.

I.E.E. (S. Midlands Graduates and Students). Joint meeting with University of Birmingham Electrical Engineering Society. Birmingham University. 6.30 p.m.

I.E.E. (London Graduates and Students). "Magnetic Amplifiers in Power Engineering," M. J. Pope. Medway College of Technology, Chatham, Kent. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. Symposium on the Dounreay Fast Reactor. Birdcage Walk, S.W.1.

INSTITUTION OF PRODUCTION ENGINEERS (S. East). "A Progress Report on the Production Control by Computers," B. L. J. Hart. Old Ship Hotel, Brighton. 7 p.m.

MINISTRY OF WORKS. "The R.I.B.A. Form of Contract—Nominated Sub-contractors," I. N. Duncan Wallace. Y.M.C.A., Connaught Hall, Blackett St, Newcastle upon Tyne. 7.15 p.m.

I.E.S. (Edinburgh). "Lighting of Outdoor Industrial Plant," J. G. Holmes. Y.M.C.A. Social Room, 14 South St, St. Andrew St. 6.15 p.m.

I.E.S. (Swansea). "Lighting and Industry in the Soviet Union," E. H. Norgrove. Demonstration Theatre, S.W.E.B., Kingsway, Swansea. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N. Eastern). "Human Engineering," S. G. Ramsay. Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Rd, Newcastle upon Tyne. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Radar Group). "Flight Evaluation of Airborne Electronic Equipment," H. G. Hinkley. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

I.E.E. (Sheffield Graduates and Students). "Noise with Particular Reference to Transformers," P. J. Bennett. College of Technology, Rotherham.

I.E.E. (Bristol Graduates and Students). "Ferrite Storage in Digital Computers," P. J. Commerford. Gloucester Technical College. 7 p.m.

A.S.E.E. (Halifax). "Design of Fittings," K. F. Haylor. Crown Hotel, Horton St. 7.45 p.m.

A.S.E.E. (N. London). "Control Systems on London Transport Signalling," G. R. Kent. Wood Green Civic Centre, Town Hall, N.22.

A.S.E.E. (S.E. London). "Coal Mines and Electricity," P. W. Wyke. Eltham Green School, Queenscroft Rd, S.E.9. 7.45 p.m.

A.S.E.E. (Preston). "Ernie," C. Ashworth. R.A.F.A. Club, East View. 7.30 p.m.

I.E.E. (S.E. Scotland). Joint meeting with Institutions of Civil and Structural Engineers: "Zambesi Hydro-electric Development at Kariba—First Stage," T. A. L. Paton and J. L. Blackburn. North British Hotel, Edinburgh. 6 p.m.

THURSDAY, 8 DEC.

I.E.E. (Utilisation Section). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (W. Wales). Informal meeting. S. Wales Electricity Board, The Kingsway, Swansea. 6 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Recent Progress in Microwave Valves," A. H. W. Beck. Cavendish Laboratory. 8 p.m.

I.E.E. (N. Scotland). "Induction Generators for Electricity Supply," C. L. C. Allan. Electrical Engineering Dept., Queen's College, Dundee. 7 p.m.

I.E.E. (N. Staffs Graduates and Students). "A Visit to the U.S.S.R.," A. Asbury, T. E. Calverley and D. Kilby. Stafford.

I.E.E. (N.W. Graduates and Students). "Space Heating," A. Shorrock. Engineers' Club, Manchester. 7 p.m.

I.E.E. (Southern Graduates and Students). "Power From the Atom," K. W. Huddart. Portsmouth College of Technology. 6.30 p.m.

I.E.E. Faraday Lecture: "Transistors and All That," L. J. Davies. Colston Hall, Bristol. 6.45 p.m.

INSTITUTION OF PLANT ENGINEERS (N. East). "Fine Measurement," J. R. Adams. Roadway Hse, Oxford St, Newcastle upon Tyne. 7 p.m.

PLASTICS INSTITUTE (Southern). "Which?" a speaker from Consumers' Association. Chemistry Dept., University of Southampton. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). "Statistics," J. R. Judd. M.A.N.W.E.B. Industrial Development Centre. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Tees-side). "Chromatography," T. B. Kent; and "Practical Aspects of Plant Measurements," M. S. Beck. Cleveland Scientific and Technical Institute, Corporation Rd, Middlesbrough. 7.30 p.m.

I.E.S. (Glasgow). "Lighting of Outdoor Industrial Plant," J. G. Holmes. Joint meeting with A.S.E.E. British Lighting Council, 29 St. Vincent Pl. 6.30 p.m.

I.E.S. (Manchester). "Ship Lighting," J. T. Grundy and C. H. Vaughan. Demonstration Theatre of N.W.E.B., Town Hall Extension. 6 p.m.

A.S.E.E. (Bradford and District). "Miniature Circuit-breakers," S. W. Hornsey. Midland Hotel. 7.30 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

British Electronic Industries Ltd., Radio Wks, St. Andrews Rd, Cambridge. To acquire for the purpose of amalgamation all or any of the shares (or the stock representing the same) of Pye Ltd. and E. K. Cole Ltd. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Charles O. Stanley and Eric K. Cole.

Cox and Rawlings Ltd., 44 Arwenack St, Falmouth, Cornwall. Manufacturers of and dealers in domestic, household and general electrical and other equipment, etc. Nom. cap.: £2,000. Dirs.: Leslie J. H. S. Cox, Philip I. Rawlings and Wm. D. Welch.

W. S. L. Davidson Ltd., 167 Tankerton Rd, Whitstable. Electrical engineers, etc. Nom. cap.: £200. Dirs.: Dorothy B. Styles and Wm. S. L. Davidson.

Euphonic Electrical Co. Ltd., 57a High Rd, Ilford. Nom. cap.: £100. Dirs.: Reginald A. Hampton and Kurt Taussig.

C. Freestone and Sons (Windsor) Ltd., 93 Clewer Hill Rd, Windsor, Berks. Engineers (electrical) and contractors, etc. Nom. cap.: £1,000. Dirs.: Cecil A. Freestone and Mrs R. M. Freestone.

Gordon Mustoe Ltd., 5 Tivoli Pl, Cheltenham, Glos. Manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £100. Dirs.: Gordon F. A. Mustoe and Mrs M. C. Mustoe.

Haffenden-Richborough Ltd., Ridgford Hse, 9 Clarges St, W.1. Nom. cap.: £100. Manufacturers of and dealers in rubber and plastics goods and to co-ordinate the group of companies comprising W. W. Haffenden Ltd., Richborough Rubber Wks Ltd, Sandwich Engineering Co. Ltd., and the subsidiaries thereof, etc. Dirs.: not named. Subs.: Wallace W. Haffenden and Trevor W. Haffenden.

A.S.E.E. (S.W. London). "Electric Floor-warming," J. Cook; and "Instrument Transformers," R. Halloway. Prince of Wales Hotel, S.W.19. 8.30 p.m.

FRIDAY, 9 DEC.

I.E.E. (N. Eastern). "The Shielding of Over-head Lines Against Lightning," J. H. Grindley. Carlisle Technical College. 7 p.m.

I.E.E. (N. Scotland). "Induction Generators for Electricity Supply," C. L. C. Allan. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.

E.P.E.A. (Meter Engineers' Technical Group). "Electronics and Metering," A. J. Baggott. Caxton Hall, Westminster, S.W.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Midlands). "Training of Instrument Engineers," Prof J. E. Parton. Lecture Theatre of the Byng Kendrick Suite, at the Gosta Green College of Technology, Aston St, Birmingham. 7 p.m.

MONDAY, 12 DEC.

I.E.E. (Electronics and Communication Section). "Topology Concepts in Network Theory," P. R. Bryant. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Western). "Engineering Education at the Technical Universities in Western Germany," D. B. Welbourn, Professor D. B. Spalding and G. L. Ashdown. Bristol University. 6 p.m.

I.E.E. (N. Staffs). "Recent Developments in Colour Television," I. J. P. James. Duncan Hall, Stone. 7 p.m.

I.E.E. (N. Ireland). "Pumped Storage," R. W. Mountain. Joint meeting with Northern Ireland Association of the Institution of Civil Engineers. Civil Eng. Dept., David Keir Bldg, Queen's University, Belfast. 6.30 p.m.

I.E.E. (N. Eastern). Lecture: "Street Lighting," W. R. Stevens and H. M. Ferguson. Supported by their paper entitled "A Survey of Street Lighting and its Future." Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (Mersey and N. Wales). "The Potentialities of Artificial Earth Satellites for Radio-communication," W. J. Bray. Town Hall, Chester. 6.30 p.m.

BIRMINGHAM ELECTRIC CLUB. "Subscriber Trunk Dialling," H. E. Francis. Grand Hotel. 6.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Manchester). "History of Pneumatic Control," G. E. Twist. College of Science and Technology, Sackville St. 6.45 p.m.

I.E.S. (Leicester). "Stage Lighting," E. E. Faraday and W. J. Furze. Nottingham. 6.15 p.m.

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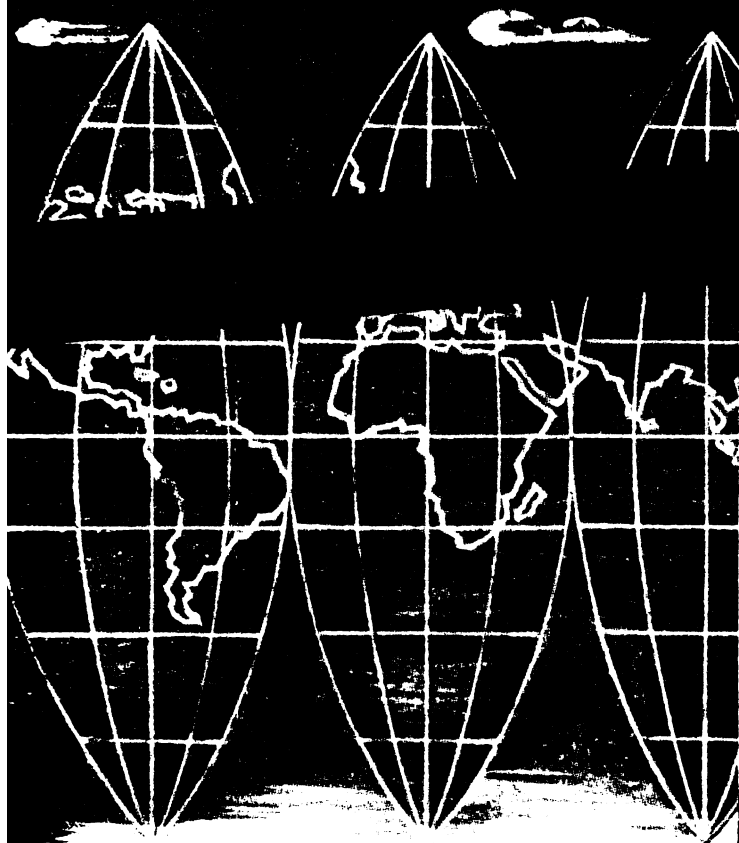
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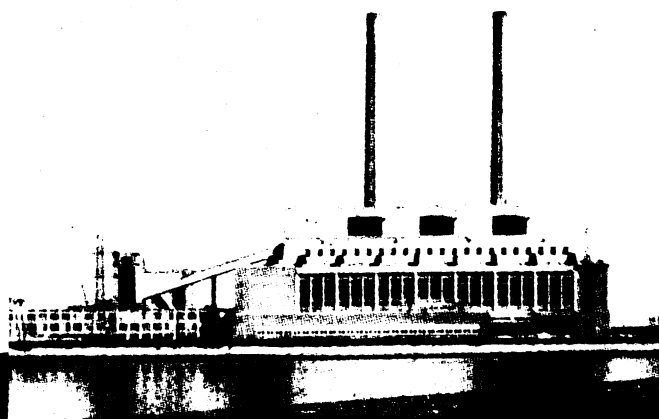
ELECTRICAL TIMES



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WEST INDIES. (Above) Babcock oil-fired, Type FP, Integral Furnace boiler plant at Barbados Light and Power Co. Ltd. power station.

GREAT BRITAIN. (Below) Blyth 'A' power station, equipped with four 860,000 lb./hr. (120 MW) Babcock p.f. - fired Radiant boilers.



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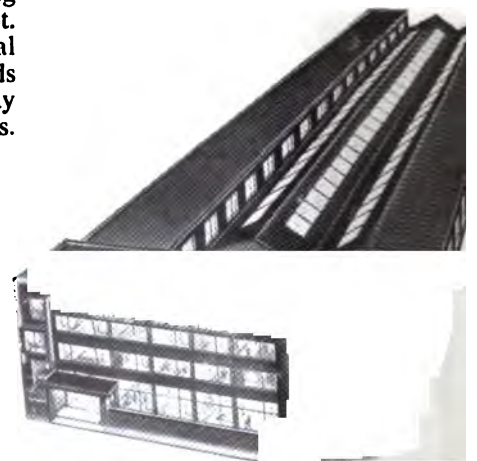
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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 8 DECEMBER, 1960

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Comment

YARDSTICK ON APPLIANCE SALES

The most comprehensive study yet of three main domestic electrical appliances (and television) was published last week by the National Institute of Economic and Social Research and summarised in our last issue. This survey comes at an appropriate time for the industry, when there is need for serious heart-searching, but it brings little consolation. It suggests that for washing machines and vacuum cleaners and refrigerators, present productive capacity is in excess of any demand that is likely to arise within the foreseeable future. Nor can too much be hoped for from changes in Government policy. If hire-purchase restrictions were removed entirely it is considered that sales of washers might rise by 10% and cleaners by less than 5%; for every 1% change in price (including purchase tax) sales vary by 1% to 2%. Although regression coefficients have been determined for h.p. and price for these two appliances, this has not been possible in the case of refrigerators. This appliance has the lowest saturation and only recently have sales been moving towards the larger markets of the lower income group. None the less, the top sales figure is put at 1.4 million a year because there will be little immediate replacement demand. In coming years, replacement demand will become of paramount importance for washers and cleaners, the curve rising more steeply in the former case, but both reaching about 75% of home sales by 1970. This, perhaps, is the more important lesson that the industry has to learn from this major exercise in statistics. If, by outstanding advance in design, new appliances can be made so attractive that the effective life in consumers' hands of older appliances can be reduced, so that they are replaced for obsolescence rather than decrepitude, there must be an acceleration in the replacement market. This challenge would be severe under any circumstances, doubly so for a section of the industry that has not distinguished itself in recent years for native originality.

DIESELS NOT THE ANSWER?

Rumours about what the Government will decide on the future of British Railways' London Midland modernisation scheme abound at present, with an official announcement expected daily. In particular, the possibility that electrification may be dropped is being widely discussed. But if electrification is abandoned it will be against the advice of the committee of MPs who have most closely studied the question and also against the judgment of the British Transport Commission. And what of the alternative? Use of diesels has the immediate attraction of lower initial capital investment, but anyone who presses that solution must take pause

from the review of experience with diesels on US railways which an American consulting engineer presented to the Institution of Mechanical Engineers last week. Analysis of financial statistics after 20 years of operating diesels brings no support for the claim often made that they are producing a 30% return on the investment made in them. Indeed, a break-down of costs suggests that for main line applications the saving on diesels in comparison with steam locomotives compares unfavourably with annual charges on the capital involved. Further, although the paper is concerned only with a comparison of steam and diesel locomotives, it is clear from what it has to say that some of the ways in which diesels fall short of expectations would not apply to electric locomotives. Discussion on the paper showed that some of its conclusions are not readily accepted here, and the author has since commented favourably on British diesel-electric design in comparison with American. As against that, US experience includes at least one reversion from dieselisation to electrification.

SCHOOLS MINISTRY WAS WRONG

One of the many prejudices off-peak heating has had to fight is an official Ministry of Education ruling that it is unsuitable for school heating. Scottish experience might have been accepted as indicating the improbability of this but, instead, facts and figures have been demanded and on the first few results storage heating was proscribed. Now a convincing demonstration that the claims of storage heating to consideration in this field cannot be summarily dismissed has come through Electricity Council trial installations. Results show clearly that with block storage heaters installed in schools of pre-1914 construction, the overall costs of hot-water radiator systems can be matched, even at the comparative fuel prices applying two years ago. More recent changes in fuel and labour costs probably shift the balance more definitely in favour of electrical methods; but the essential point of the test is clearly established. It is that there is little basis for a claim that hot-water heating is so overwhelmingly more economical than storage electrical heating that the latter should be ruled out by Ministerial ukase. Early adjustment to the Ministry's advice to local authorities on this point must now be sought.

HOW TO WIELD THE H.P. WEAPON

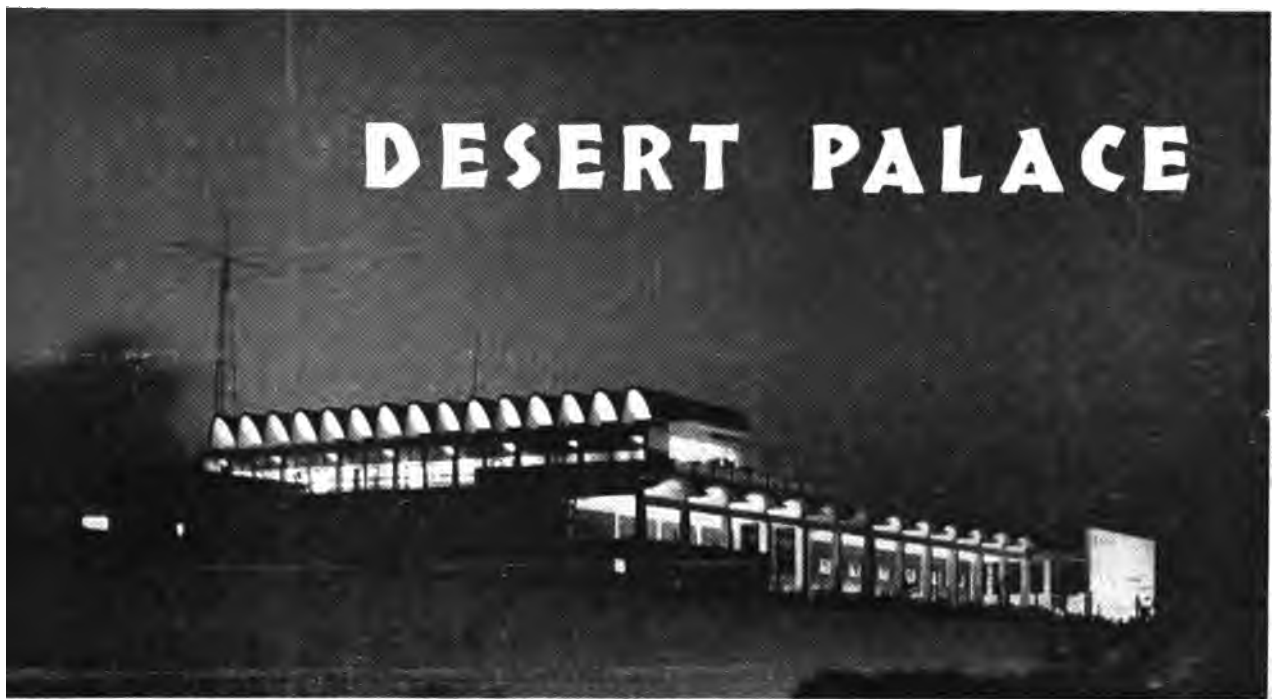
In recent months the electrical manufacturing industry has indicated to the Government that it would rather have stability in hire-purchase legislation so far as size of initial deposits and limitations on hire periods is concerned, than freedom from all restrictions for much of the time, interspersed with suddenly introduced sharp limitations. The reason is clear. Industry has to invest so much in producing a major domestic appliance that it wants to be able to estimate its market; and few factors are so likely to upset an estimate as a change in h.p. regulations.

Last week the Government, through a Parliamentary answer, flatly rejected the idea. Despite soft words about the desirability of assisting forward planning by industry, it was made clear that the Government thinks the h.p. weapon too valuable an instrument of its armoury for fighting economic upsets to be discarded. Once that stand is taken, however, emphasis is given to another criticism of the Government in relation to h.p. Is the weapon being wielded to the best effect? There is a strong suspicion that the impact of this essentially blunt instrument comes too brutally and too late. More frequent changes smaller in magnitude would reduce the margin for error in its use—and reduce as well the upset to manufacturers. It has to be remembered in this context that the situation will never be the same as in the last h.p. boom. Finance houses, having burnt their fingers through bad debts then, are likely to proceed more soberly in future.

ECONOMICS OF R.P.M.

Most writing by professional economists on the subject of resale price maintenance damns the practice. The arguments as presented fit together snugly enough but seem to most people engaged in business to be somewhat lacking in reality. A rational explanation for that impression comes in a booklet, *Fair Trade*, published by Macmillan's last week. The authors are two professional economists who feel that their fellows have overstated the case for prohibiting RPM. In the preface to their work they say how initially they wished to show that the case for a Government ban on RPM was not so "open and shut" as the tone of most critics suggested. By the end of their exercise in devil's advocacy, they find themselves in a more advanced position, impelled by their own argument to declare their belief in a general case for the retention of individual RPM. Between these points of different emphasis appears to have come the application of the traditional scientific method, the checking of hypotheses against all relevant available observations—a technique that has not been exploited with any notable vigour by those who have argued against RPM. Information available includes some detailed reports of North American experience when RPM has been made illegal or ineffective. From this it is clear that major domestic electrical appliances are particularly vulnerable to the price-cutting and loss-leader tactics of large stores once RPM is abandoned. That vulnerability, once exploited, results in long-term losses to manufacturers which is not balanced by any sustained advantages to the purchasing public. In the UK, traders must wonder whether the facts they are reporting are giving a similar impression to the officials of the Board of Trade, currently carrying out an inquiry into RPM in Britain. On that may depend the pattern of retail trading here during the next decade.

Meteor



PERIENCES OF A MODERN GENIE

R. W. Shaw,* M.I.E.S., M.J.Inst.E.

my youth I was an avid reader of *Tales from the Arabian Nights*, those fabulous stories in which, on occasions, a genie would appear and carry out the fantastic tasks in an incredibly short time. I often to imagine the picture from the genie's point of . How did he plan his operations? Did he have tance from other genii? What were his labour lems? Today, I think I may have the answer to at some of these questions.

ace in the Desert

all began with a visit to the house of an architect : one evening late in 1958. It seemed that a powerful : had summoned him and ordered: "Build me a palace ere!"; "there" being a spot in the desert some miles : a town. From the plans he laid before me it was ent that he was an imaginative and contemporary w. It would be my task to light the palace and oundings in the most modern style. I had a completely hand.

ie palace was to be built on a low, man-made hill, : 12 ft high, faced with black stone. It would have usual quarters for the sheik and his family, a wing guests, a block for the servants, walled gardens, iming and fountain pools and an entrance courtyard. ve discussed the plans and he described the details, ideas rapidly began to form and take shape. Equip- : was ordered and dispatched to the site, where con- tion was pressing ahead. In October, 1959, I flew not by magic carpet) to the Persian Gulf and made ray to the palace. In the succeeding weeks, installation

and erection of the equipment went ahead while new ideas were born, developed, executed and added.

Now let us suppose that the palace is complete—as, indeed, it now is—and that we are approaching it on a fine, dark Arabian night. We shall discuss the problems as we go.

Leaving the main road stretching out across the desert, we take the special road to the palace where, ahead, a 30 ft illuminated pylon stands shining. This is a brass framework, polished and waxed, built around a central 3½ in. steel tube supported on a concrete foundation 12 ft deep in the desert sand. White glass panels protect the 24 4 ft 40 W "Tropical Daylight" fluorescent tubes which are installed, together with the starter switches, inside the pylon. These are the only units with starter switches in the palace, all other fluorescent lighting incorporating quick-start gear. Because of the hot noonday sun, the ballast gear is housed in a ventilated enclosure in the guard house, of concrete faced with marble, which stands at the entrance to the palace road.

* Senior Commercial Engineer, Atlas Light and Lighting Ltd.

vel lighting on the palace road gives an impression of riding on a sea of light





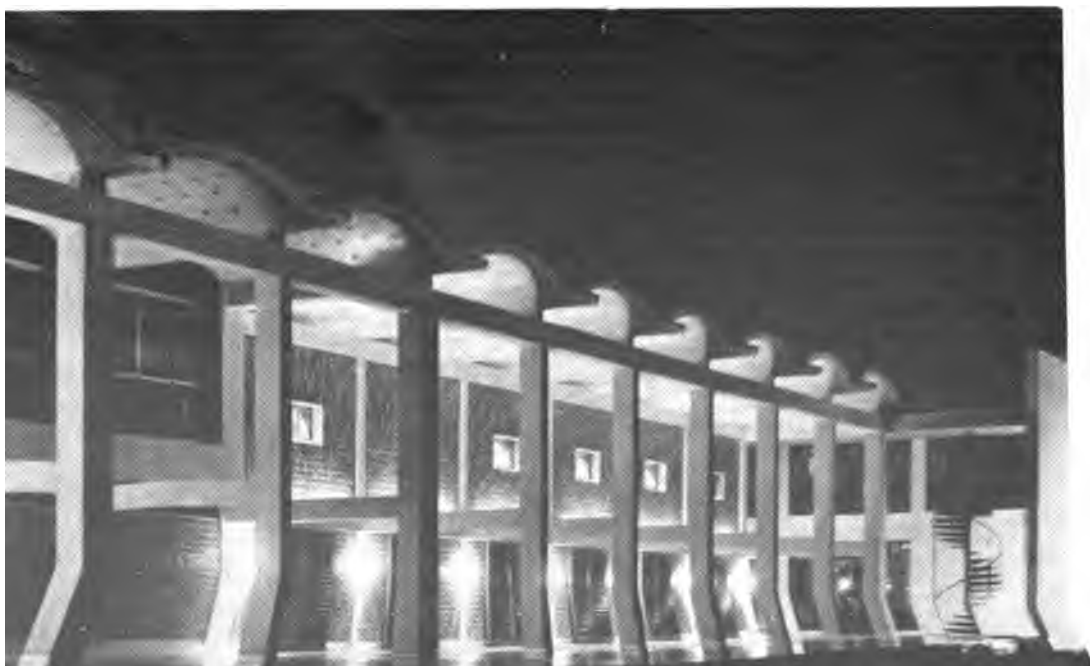
Garden in the family quarters by night. The short mushroom fittings add interest and create a airy-like atmosphere

The road, sweeping from the guard house, around the palace and rising by the walls to the level of the courtyard, appears as a sea of light. The 1 ft high concrete retaining wall incorporates recessed fluorescent lighting in sandproof reflectors designed to concentrate all of the light in a flood across the road. This continuous line of light stretches 450 ft up and around the corner to the main courtyard. Beyond, similar fittings, mounted on brackets and spaced 20 ft apart in the grass verges, illuminate the upper perimeter road.

The courtyard is separated from the perimeter road by a fountain pool and is approached across a bridge at the south east end, a low concrete structure which also serves to support the colour change lighting for the pool and floodlighting for the adjacent courtyard wall. For pool lighting, three rows of nine 80 W fluorescent tubes in pink, blue and green are housed in bronze tube mounts, together with waterproof cathode heating transformers, on the underside of the bridge overlooking the pool. The three-colour electronic automatic dimmer and colour change unit is housed in the pump-room.

On my arrival, this unit was discovered in a rough tarpaulin shed which was by no means sandproof. It was badly damaged, covered with sand and with many broken parts, none of which was obtainable locally. Demanding a completely sandproof corner in true genie style—and getting it—I stripped the unit down, made some repairs and, with a little luck, succeeded in making it work.

On the opposite side of the bridge, nine twin 80 W fluorescent anodised fittings flood the black and white pierced tile wall which separates the courtyard from the women's quarters. The courtyard is paved and pebbled, also in black and white, with recessed tungsten filament lamps sunk below the paving stones at the intersections and a glazed aperture, 2½ in. in diameter, on a level with the paving. The 60 W lamps rely entirely on soil conduction for cooling and 85 of these units are used in the courtyard. The east and



The patio in the guest block. The wall brad are by Allom Heffer and the blue mosaic dome illuminated by "Tropi Daylight" fluorescent

, a formal, airy,
is illuminated
stal ceiling and
upplemented by
pelmet lighting



south walls are floodlit from fluorescent tube units, with 1½ in. thick glass covers, sunk level with the paving. Heavy vehicles, including water tankers, pass over both types without harming them.

The main entrance porch, projecting into the courtyard, is faced with gold mosaic, illuminated by concealed 80 W tubes. The adjacent screen wall, in pale green ceramic tiling, is also illuminated by 80 W tubes installed behind the marble facing panel at the top of the wall. Part of this light also illuminates the teak screen and entrance door while, above the porch, a series of vaulted roofs, open at each end and clad on the inner surface with blue mosaic, is also illuminated by concealed fluorescent tubes. To the right and above the personal quarters, other vaulted roofs, open at each end and with gold or yellow mosaic interiors, are illuminated from concealed tungsten filament weatherproof fittings. These roofs also serve to conceal water tanks and the upper surfaces of the roof sections are sheathed with burnished copper.

The Interior

Entering the palace, we find before us the entrance to the main salon, where guests and visitors are received. This large, formal room is illuminated by fine crystal electroliers, suspended from the ceiling, and by half units, also of crystal, on the mirror panels in the walls. Both of these are of GEC design and manufacture. The curtained windows are illuminated by concealed tubes in the pelmets, and the centre floor unit also incorporates concealed fluorescent lighting.

To the left of the salon lies the guest wing in which are situated four bedrooms and the sitting-rooms. The latter, on the ground floor, lead out to the patio, pillared and with blue mosaic domes which are illuminated by tubes in sandproof fittings concealed in the upper

osing forecourt
tain pool with
ement lighting.
sof and balcony
family quarters
n be seen above





View above the floating tile ceiling in the dining-room showing the lighting arrangement with, inset, detail of the tube-tray and carriage

beams. Local lighting is from brackets of an unusual design created by Allom Heffer. The wall itself is glazed with pink ceramic tiling which, like all the tiling in the palace, is of Italian manufacture. Lighting in the guest quarters is by local tungsten filament desk lamps with supplementary concealed pelmet lighting.

Returning to the entrance hall, we find on our right the lift which serves the family quarters and, on the ground floor, the ante-room and the dining-room. Lighting for the former is from a George Forrest ceiling unit of unique design. It is in the form of a 13 ft circular ring of black iron suspended on rods a short distance from the ceiling with 20 matt chrome finish brackets and Forrest Modern glassware spaced evenly around the periphery.

Beyond the ante-room lies the dining-room, the lighting of which proved the severest test of genieship. This large salon, with pelmeted windows giving on to the lawns, has an unusual roof in the form of a floating ceiling of Italian plaster tiles projecting from one wall and supported from the true ceiling on rods but spaced some 18 in. from the remaining three walls. The tiles are covered with innumerable nodules, the tops of which have been sliced off to give $\frac{1}{4}$ in. holes through which the light from the ceiling can shine. It was my task to provide the light from above the tile ceiling, which was too fragile to bear any weight.

The problem was solved by suspending a number of curtain tracks from the true ceiling and running out sections of channel, with 80 W tubes strapped to them, on wheeled runners from service hatches at the wall where the false ceiling joined. In all, 40 tubes were installed in addition to a further 42 in banks of three colours located close to the edge. These served to flood the green silk weave curtains covering the white tiled side walls of the room in any one colour to choice. The ballast gear was housed in the room behind the service hatch.

Not so easy was the task of persuading the electricians to install the reflector tubes chosen for this location the right way up. Despite several demonstrations, including the breaking open of a tube to show the opaque reflecting service, they would persist in mounting them upside down. Eventually, in despair, I decided that this was a problem even a genie could not solve and changed them to the ordinary kind. It's the simple things...

The women's veranda, which also contained a swimming pool, is a pillared enclosure with recessed ceiling alcoves paint-sprayed in two tones of grey. In each alcove a single spun bowl of polished copper, pierced above and below in geometrical patterns, enclosed a tungsten filament lamp. The subdued light from the lace-like pattern on the alcove surface provided discreet illumination in the

quarters, while small floodlights were used to illuminate the bath. Perforated screens in one wall of the dining-room also permitted the women to view the screen when a cinema show was being given, a projection-room and motorised screen (which would persist in rising without warning until I adjusted its mechanism) being part of the dining-room installation.

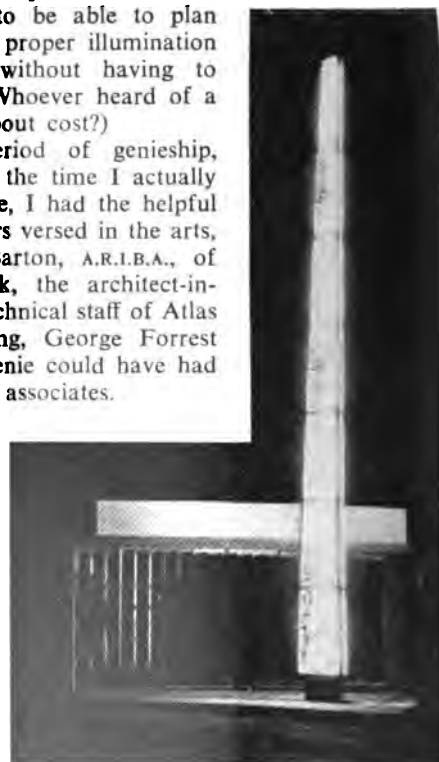
The private rooms of the sheik and his family are all illuminated by tungsten filament lamps in the form of pendants, standards and table lamps, supplemented by fluorescent pelmet lighting. This treatment extends to the two principal bedrooms and sitting-rooms. One of the bedrooms is circular in shape with a domed ceiling coming down to the curtained walls and pelmeted windows. Above the false ceiling, fluorescent tubes are used to shine down on the curtains. In the sitting-room another false ceiling, adjacent to the window area, incorporates a number of tungsten filament spotlights in colour as well as fluorescent lighting, while the gold-faced pelmet is pierced to allow a pattern of light to shine through.

The Gardens

Lighting of the gardens was designed on the spot. The women's garden has, as its main feature, an open circular pavilion with vertical slatted shutters which can be adjusted to any position. For this we conceived a number of suspension fittings in the form of a wide copper tube, closed at the upper end, pierced with a number of Eastern pattern holes and housing a tungsten filament lamp. No such fitting being available, we made up a prototype from copper tubing, borrowed from the palace plumber's workshop. This, after giving us the required lighting, was taken to the local metal-worker who fabricated the finished spun and polished copper lanterns in a matter of hours with all the polish and skill of Eastern craftsmanship. Other features in the garden are marble seats with gold fluorescent tubes mounted underneath and short mushroom fittings dotted about the grounds.

There are, of course, other lighting features which are of conventional pattern, such as the bulkhead fittings which are used in service quarters. It was a pleasant change to be able to plan lighting, both for proper illumination and for effect, without having to count the cost. (Whoever heard of a genie worrying about cost?)

During my period of genieship, when for part of the time I actually lived in the palace, I had the helpful assistance of others versed in the arts, notably Mr J. Barton, A.R.I.B.A., of Farmer and Dark, the architect-in-charge, and the technical staff of Atlas Light and Lighting, George Forrest and others. No genie could have had more co-operative associates.



The 30 ft pylon and guard house by night

Post insulator for 380 kV

DESIGN DICTATED BY MECHANICAL RIGIDITY REQUIREMENTS

NT plans to upgrade the British Super Grid 275 kV to 380 kV has been one of the reasons for the introduction by Doultons Industrial Ltd. of their Multicone post insulator. In the latest insulators the two complementary factors of strength and rigidity become increasingly significant at high voltages. A certain minimum rigidity is essential for isolator-switch applications. Height reduction increases rigidity, at the same time it decreases weight. This is also important in possible situations of installation indoors. Until now, the type of insulator commonly used in this country has been the pin multi-unit pedestal. But even for 275 kV, a 10 ft high and it only just fulfils specified requirements for maximum cantilever deflection. Thus, the working and above the pedestal design is not feasible.

On the continent, the problem has been solved for many years now by the successful use of post insulators of the Multicone type. Doultons, in collaboration with Merlin-Gerin, of Grenoble, have, in fact, designed the Multicone insulator.

Construction

The method of construction employs conical porcelain elements, each integral with a shed, which are stacked one upon the other and cemented together to form a solid section of insulator pillar or post. The British version differs from the French in that anti-fog sheds instead of plain sheds are employed and the unit has a greater mean diameter. This allows for the more stringent requirements of British Standards in respect of total leakage path and mechanical strength. For convenience in handling, the Doulton 380 kV unit is broken up into three sections which are separated by bolted galvanised iron flanges. The top section is longest and has also reduced diameter sheds; this gives optimum electrical stress configuration. Overall height of the post reaches only 11 ft 8½ in.

It is the effectively "solid porcelain" construction of the Multicone post insulator, having only two metal elements, which gave it rigidity and compactness. By comparison, a 275 kV pedestal type has as many as 14 relatively flexible metal components which result in a deflection, under the cantilever working load, of more than three times that of the Multicone equivalent.

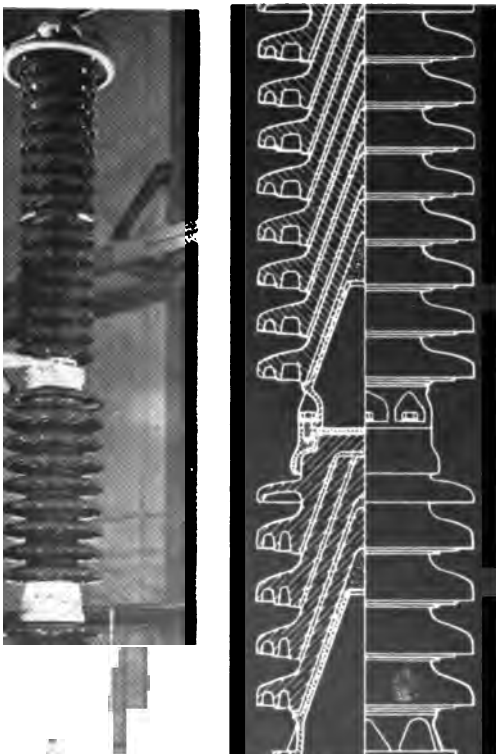
Electrical Characteristics

The new design possesses certain other merits, both from electrical and manufacturing standpoints. Thus, its relatively uninterrupted surface profile makes for uniformity of electric field, resulting in higher flashover values than for the conventional design. Furthermore, breakdown is not limited by puncture strength of the porcelain body, which is much greater than that of the surface flashover value. This is one drawback of the hollow cylindrical type of insulator, where there is the possibility of the ingress of moisture onto the inner wall, promoting conditions for puncture to take place.

Another advantage of uninterrupted profile is that a maximum number of sheds can be accommodated for a given maximum height for impulse flashover. Leakage path provided is in the region of 1 in./kV. Finally, with the pillar design adopted for the 380 kV unit, a satisfactory corona level of 280 kV can be maintained using a stress grading ring of only 22 in. diameter. This helps to reduce spacing of units in substation layout necessary to comply with specified electrical clearances.

Ease of Manufacture

Manufacture of Multicone conical elements is considerably eased by their manageable size. They lend themselves during initial formation from wet clay to the much-favoured "jollying" process. They are also suitable for firing in a tunnel kiln, where it is possible to maintain closely controlled conditions. In addition, the design affords a good deal of flexibility in the making-up of complete post insulators. Thus, a variety of specified voltage ratings can be catered for simply by adding or subtracting an appropriate number of conical elements.



Multicone post insulator. Construction, shown on right, and gives much greater rigidity than corresponding pedestal type

Block heaters in schools

TESTS SHOW THEY COMPETE WITH HOT-WATER RADIATORS

IT costs no more to heat a school by electric thermal storage block heaters than by a hot-water radiator system. That is the conclusion from tests carried out to check a Ministry of Education ruling that off-peak electric heating did not lend itself to economic use in schools. When that opinion was promulgated, the supply industry arranged with the Ministry for comparative tests to be carried out on pairs of similar schools in different parts of England. One school of each pair was heated by a normal hot-water radiator system, the other by thermal storage block heaters. The tests are described and the results discussed in a report published by the Electricity Council.*

The table shows the characteristics of the schools selected and the heating systems involved in the test. All the schools are relatively old, erected at the turn of the century, and each pair are of relatively similar construction. However, the calculated heat losses are far from being identical, a point to be borne in mind when comparing costs.

In the tests, continuous temperature records were obtained by placing thermographs in a few rooms judged to be representative of the whole building. Electrical heating was on a basis of a maximum charging period of nine hours a day, with omission of the Friday/Saturday night period.

* Utilisation Research Report No. 16: Comparative tests on heating school buildings by electric thermal storage block heaters and other methods. Available from Information Officer, Electricity Council, Trafalgar Buildings, 1 Charing Cross, London S.W.1.

On average, all the systems installed maintained the Ministry requirement of a minimum temperature of 62°F. During the coldest week all systems failed to maintain this temperature, but the report suggests that performance of block heaters was generally better than that of hot-water systems. On the whole, early morning temperatures were higher with block storage heaters, while the 4 p.m. temperatures were about the same for both systems.

An inquiry was made to obtain teachers' assessments of comfort conditions in the instrumented classrooms. Opinions varied somewhat as to which of the systems was the more "comfortable," as distinct from too warm or too cold, but the balance of preference was with the electrical systems.

One of the indications of the tests has been that so far as block storage heaters are concerned, considerable economy can be achieved by choosing a suitable control system and ensuring that it operates satisfactorily. The tests suggest that average consumption for a school heated by block heaters is about 26,000 kWh/therm of calculated heat loss/year; 900 kWh/kW. Solid fuel consumption corrected to the same degree days basis and design temperature is 7.3 tons coke/therm of calculated heat loss/year. For oil, 1,190 gal/therm/year.

Cost figures shown in the table are based on 25-year depreciation, reckoned generous for solid-fuel installations and conservative for electrical installations; and on 5% interest on capital. Total annual cost per therm of calculated heat loss ranged from £108 to £177 for electrical systems, and from £110 to £172 for coke. For the oil-fired school it was £213.

CONSTRUCTIONAL, INSTALLATION AND COST DATA

Location of Schools	Heating	Method of Control	Design Internal Temperature	Calculated Heat Loss		Building Construction			Floor Area	Installed Heating Load (Electric)	Capital Cost	Total Annual Cost
						Walls (all solid)	Roof	Floor				
Manchester	Block heaters	Maclaren regulator and room thermostats	°F 60-65	therms 1.12	kW 32.5	in. 14	Slate roof with plaster-board ceiling and 1 in. fibreglass insulation	Timber on joists	sq ft 3,120	kW 39	£ 880	£ 177
	Coke-fired	Room thermostats and time-switch for night period	62	1.6		14	Slate-roof with plaster-board ceiling and 1 in. fibreglass insulation	Timber on joists	3,050		1,145	275
Kingston-upon-Hull	Block heaters	Maclaren regulator	62	9.74	285	13	Slate-roof with plastered ceilings	Timber on joists	12,800	331	7,560	1,535
	Coke-fired	Banked fires from Saturday morning until Monday morning	62	8.78		18	Slate-roof with plastered ceilings	Timber on joists	13,800		5,250	1,147
Leicestershire	Block heaters	Internal and external thermostats (QA/QR)	62	1.06	31	14 and 19	Slate roof with lath and plastered linings and suspended ceilings	Timber on joists	1,570	31	555	146
	Coke-fired	Fires drawn on Friday night, relit Sundays	62	1.5		18	Slate roof with lath and plastered lining	Timber on joists	1,645		665	165
Birmingham	Block heaters	Internal and external thermostats (QA/QR)	62	2.28	67	13½	Tiles on battens with lath and plastered lining	Wood-block on concrete	4,300	86	1,335	248
	Oil-fired	Night shut-off	62	2.86		13½	Tiles on battens with lath and plastered lining	Wood-block on concrete	4,720		3,590	609

Marine self-regulating alternators

by J. Griffin, A.M.I.E.E.

PART 1

In an earlier article¹ on the general subject of marine alternator practice, it was noted that the special instances obtaining aboard ship had created a demand for an alternator with superior transient voltage characteristics. The article went on to consider the consequent entry into the marine field of the "self-regulating" alternator, in which the inherent characteristics of the alternator are modified by means of load-current compounding. It was mentioned that in most of the available machines a static excitation system is substituted for the conventional rotating advantages in respect of inherent reliability, maintenance and layout flexibility naturally

proposed in this article to examine briefly four of the self-regulating marine alternators currently available.

Three are of British origin and have been in their present form only recently; the fourth representative of a number of Continental machines similar in principle (though often differing widely in detail, some of which have been available for some

Problem

Since the original development of the synchronous machine, attempts have been made to solve the problem of voltage regulation. Many of the attempted solutions have been extremely ingenious, and some have pointed the way to the more or less successful solution of today; most of them, however, failed because of inferior characteristics of the devices then available for the production of alternating current. It was not until the advent of the relatively modern selenium rectifier that adequate success was achieved. Development was in fact retarded by the outstanding success of the synchronous machine of electro-mechanical a.v.r., and until very recently even the more successful of the self-regulating machines found application only in the smaller sizes. The cost of the conventional a.v.r. was disproportionately high, or where the inherent reliability of a static system was particularly valuable. It is indeed, that had it not been for the introduction of marine practice, the extension into the larger fields of some of the now commercially successful self-regulating alternators would have been considerably delayed since it was really not until the special advantages for the purposes of the superior transient voltage

response performance of these compounded alternators became apparent that such machines were elevated from relative obscurity to their present prominence.

To the marine electrical engineer, used long since to the efficient simplicity of the level-compound d.c. generator, it may be rather surprising that so much difficulty has been experienced over this problem of alternator voltage regulation. There are, however, some significant and not entirely obvious differences between the d.c. and the a.c. generator in this respect; in spite of the fact that the relative proportions of the armature and field m.m.f.'s in the two types of machine are of the same order, the a.c. machine presents a much more difficult voltage regulation problem. Before considering the few selected solutions, therefore, the nature of the problem will be briefly examined.

In an ordinary d.c. generator the field winding has merely to provide sufficient magnetising m.m.f. on the direct or polar axis to maintain the required main flux; the inherent voltage regulation with load is due to the relatively small internal resistance drop in the armature circuit, and to the net on-load flux reduction occasioned by the magnetic saturation in pole-tip and armature teeth on that side of the pole whose resultant m.m.f. is strengthened by the distorting armature reaction m.m.f. In an alternator, however, the absence of the commutator and fixed brushgear permits the load current or armature reaction m.m.f. (which in the d.c. machine is confined effectively to the quadrature or interpolar axis, and is thus prevented from greatly affecting the main flux) to interfere with the field m.m.f. much more directly. The effect of the armature reaction m.m.f. varies not only with load but also with load power factor; least at unity p.f., it is greatest at zero p.f. lagging, in which condition the armature m.m.f. is in direct and demagnetising opposition to the field m.m.f. Thus in an alternator the field winding has no longer merely to provide the magnetising m.m.f.; instead it must maintain the magnetising m.m.f. against the reaction of the armature m.m.f. In practice, the resultant field m.m.f. at full-load may be more than twice the purely magnetising m.m.f.³

The on-load effect of the armature leakage reactance drop (which normally increases the internal e.m.f. necessary for a given terminal voltage, and hence requires corresponding increases in main flux and magnetising m.m.f. with increasing load) also varies with power factor, being again least at unity p.f. and greatest at zero p.f. lagging. (Although only a second-order effect, since in a normal alternator the on-load flux increase required may be of only 5 to 15%, this phenomenon cannot be ignored.)

The separate effects of armature reaction and leakage reactance (often idealised into a single effect termed *synchronous reactance*) combine to increase considerably the total excitation required for the maintenance of a

J.: "Shipboard A.C. Generators," ELECTRICAL May, 1960, Vol. 137, pp. 837-842. Mr Griffin is with Messrs. Sons and Co. Ltd.

It is appreciated that the examination of all or even the available systems would be quite impossible in detail. The above choice has been made in order to show a reasonable adequacy the machines most likely to be used by the British marine electrical engineer.

³ By way of comparison it may be noted that in a similar d.c. generator the corresponding ratio might be only about 1.10 or 1.20.

constant terminal voltage in a loaded alternator. Fig. 1 illustrates graphically the very wide steady-state⁴ excitation range required by a typical marine turbo-alternator, and it is clear that any attempt to provide the necessary excitation range inherently (i.e., in a purely passive or functional manner, rather than in response to an error-actuated automatic control system such as an a.v.r.) must perforce take proper account of the power factor of the load current as well as of its magnitude.

Compounding

Load-current compounding along the lines of the well-known d.c. compound generator is one fairly obvious approach to the alternator voltage regulation problem. In the usual rotating-field alternator the provision of a separate series winding and an additional slip-ring may be structurally inconvenient, although by comparison with the d.c. machine any difficulty is probably more than counter-balanced by the ease with which the actual load current can be reduced to a more convenient value (by means of the in-any-case-essential series transformer) before being fed to the series field winding via a rectifier. Simple compounding of this type is in fact the basis of one of the successful systems to be considered, but in principle at least this method cannot by itself provide the complete answer; although responsive to the magnitude of the load current such a system is inherently insensitive to power factor.

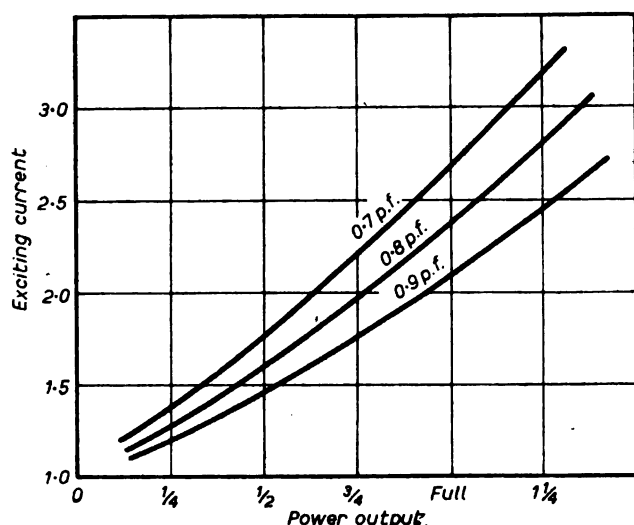


Fig. 1. Typical marine turbo-alternator excitation characteristics

Phase Compensation

All the machines to be described are load-current compounded, so that in every case the total alternator excitation contains a "series" component directly proportional to the output current. In three out of the four systems considered, the compounding is, in addition, "phase-compensated" and since the method adopted usually entails the virtual duplication, in a static excitation system, of the basic m.m.f. relationships obtaining in the alternator itself, these relationships must first be briefly examined.

To a first approximation the field m.m.f. required by an alternator can be established by means of a simple space-

⁴Considerable margins respectively below and above the no-load and full-load requirements are essential for the successful operation of any form of regulating system; in practice, therefore, the overall excitation ranges necessary may be more than twice those shown in Fig. 1.

vector m.m.f. diagram of the kind shown in Fig. 2. In this diagram, the vector F_m represents the m.m.f. required to maintain the no-load flux Φ ; the vector F_a (drawn parallel to the time-vector I representing the output current, and thus lagging by the appropriate phase angle φ on the output voltage vector V) represents the "synchronous reactance" m.m.f., which in an idealised unsaturated and distributed-field machine with a uniform air-gap combines accurately the effects of the true armature reaction m.m.f. and the leakage reactance drop. Finally the vector F_r represents the total or resultant field winding m.m.f. necessary to maintain F_m against the reaction of F_a . (The diagram shown has been drawn for a constant power output at various power factors, and it is interesting to compare the various full-load/no-load excitation ratios given by this simple diagram with the data from Fig. 1.)

The methods actually used to duplicate the alternator m.m.f. diagram in the excitation and control equipment naturally vary considerably in detail, but nearly all of them rely on the vector combination (on the a.c. side of a main field rectifier) of excitation components corresponding approximately to the magnetising and synchronous reactance vectors F_m and F_a of the alternator m.m.f. diagram. A "shunt" component (obtained from a circuit connected across the output terminals and thus providing an approximately constant contribution corresponding to F_m) is combined vectorially with a "series" component

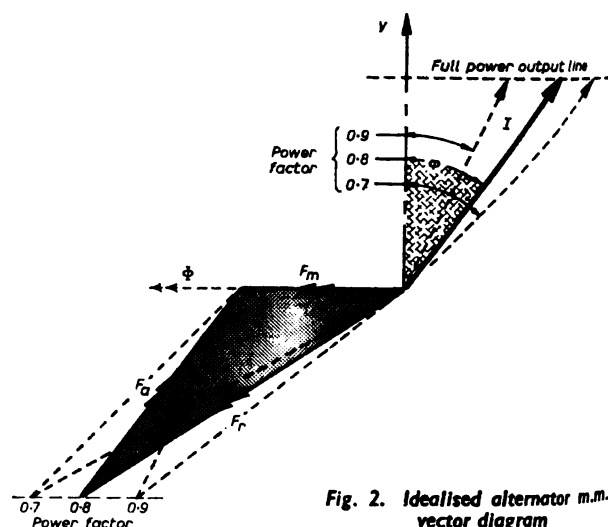


Fig. 2. Idealised alternator m.m.f. vector diagram

(almost invariably obtained from a series transformer and thus variable in both magnitude and phase and corresponding to F_a) in such a sense as to provide inherently a total excitation characteristic at least approximating to that required by the alternator.⁵

The essentially a.c. problem of combining the separate excitation components vectorially lends itself very readily to the use of such static circuit elements as transformers, reactors, and capacitors, and static rectifiers are of course the obvious choice for converting the a.c. output of the excitation system into the direct current required for the field winding. Most of the successful systems consist

⁵It should be noted that such a system is inherently a purely "functional" one, in that no attempt is made to detect departures from a set output standard and to initiate positive corrective action. Once set to give a particular and inherent output/input characteristic a functional system is unable to compensate for departures from the original design conditions (such as, for example, a change in the load/speed characteristics of the prime mover).

combinations of these static components, and all seem to have accepted gratefully the inherent reliability and the reduction in which arise from the substitution of a static re usual rotating d.c. exciter with its inevitable and brushgear.

partial self-excitation, i.e., the provision from r output of the required excitation power, is universal, notwithstanding the difficulties ith excitation initiation and the inconvenience a shunt excitation component reduction on ce of a transient voltage drop. Various circuit may be introduced to compensate for depar- the ideal in both alternator and excitation iables requiring this sort of compensation articular the increase with temperature of the : the alternator field winding, and the effects saturation.

The L.S.E. "Altoreg"

icular system is unique in that, although it presently popular technique of load-current g, it nevertheless makes no attempt at phase n. The compounding effect of the "series" of the total excitation is dependent only on le of the load current, no account being taken er factor; the additional control needed to constant terminal voltage is exercised by an exciter-fed "shunt" circuit.

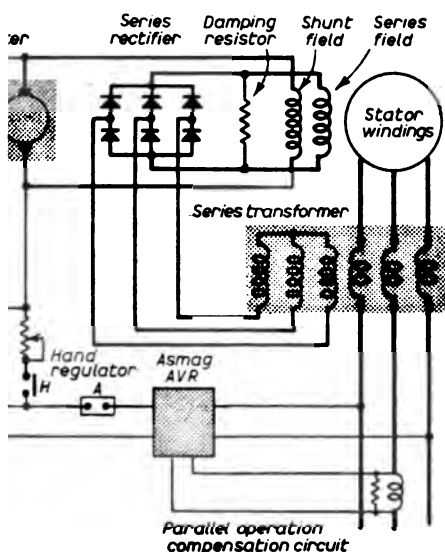


Fig. 3. L.S.E. "Altoreg" alternator system

excitation and control circuit schematic is fig. 3. The alternator is provided with two l windings; of these, one, the "shunt" winding, the armature of a normal d.c. exciter, while r "series" winding, carries the rectified output ase series transformer connected in the alter- lines. The field winding of the exciter may, b, be separately excited from the alternator nals through a static magnetic amplifier type atively, self-excitation may be employed, the being shunted across the armature and cony conventional a.v.r. The former combination, asic "Altoreg" alternator with an "Asmag" has been designated the "Altomag," and as ype most likely to be met with in normal ice no further attention will be paid here to ther variants of this interesting machine.

In the absence of any inherent phase compensation, a design choice has to be made about the relative values of the shunt and series excitation components, and these are normally so chosen that an approximately level voltage/ load characteristic is obtained at the rated power factor. The effects of load power factor (and of changes in speed or winding temperature) are compensated automatically by changes in the shunt component, i.e., by the output of the exciter acting under the continuous control of the a.v.r.

Parallel operation is normally provided for either by the usual quadrature-droop compensation or by a variant known as differential quadrature compensation.⁶ A further refinement, useful when identical machines are to be operated in parallel, consists of the direct paralleling of their series field windings by means of "equaliser" connections; dissimilar machines can also be "cross-compounded" if required, although some additional complication may be entailed.

To cater for the possibility of an a.v.r. failure and also as a convenience for testing and commissioning purposes, an "Auto/Hand" change-over switch enables the exciter field to be connected across the exciter armature via a regulator, thus converting the exciter from separate to self-excitation; an additional feedback from the alternator output to a separate bias winding on the exciter may be necessary, however, to ensure exciter stability in the self-excited condition. Initial excitation is simply obtained by

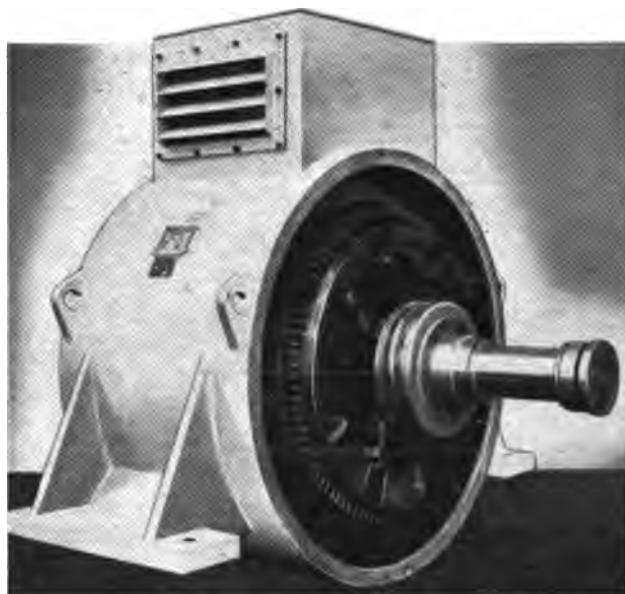


Fig. 4. 500 kVA, 750 r.p.m. distributed-field "Altoreg" alternator, with integral ventilated housing for series transformer and rectifier

means of a voltage-controlled relay which connects the exciter field temporarily across the exciter armature through a pre-set resistor; when sufficient alternator terminal voltage has been established, the relay operates to restore the normal feed to the exciter field from the a.v.r.

Three slip-rings are necessary because of the two separate field windings, but apart from this the alternator itself closely resembles a conventional machine in appearance, although the exciter can be rather smaller than

⁶The latter method also uses a current-transformer-fed resistor in the a.v.r. voltage signal feed, but inter-connections between the resistors of the paralleled machines ensure correction only in the event of actual unbalance, and the normal level voltage/load characteristic is thus preserved unaffected.

usual because it is responsible for only part of the total excitation. Internally, however, the alternator may be rather different from the conventional salient-pole machine, since when the best possible transient voltage performance is required (and especially with very large machines), a distributed-field construction is sometimes adopted. Whenever possible, the series transformer and rectifier are accommodated on the alternator itself; by arranging for them to be cooled by the alternator ventilating air their size and cost can be reduced. The only external components then requiring accommodation on the main switchboard are the a.v.r. and the usual regulators, the change-over switch, the parallel operation compensation components, and the excitation initiation relay.

The load-current compounding principle employed provides an eminently satisfactory transient voltage response performance. In general, the policy of the manufacturer concerned is to design the system as a whole for a transient voltage regulation of about 15% with a low-power-factor impact load of 100%, the recovery time⁷

for ordinary applications being normally between one-half and one second. It would at first sight appear that a phase-compensated system might perhaps be inherently better able to cope with the inevitably low-power-factor motor starting loads, but the relative independence of the "Altoreg" exciter-fed "shunt" circuit and the design of the series transformer seem in practice to promote a performance equal to that of any comparable British system.

(Part 2 of this article will describe the W. H. Allen self-regulating alternator, the GEC "Accurex" system and the Siemens "Constant Voltage" alternator.)

⁷The "recovery time" may best be defined (albeit rather loosely) as the time taken, from the instant of application of an impact load, for the voltage to recover to within, say, -2½% of normal. With most systems incorporating error-actuated control devices there will normally be at least one significant voltage overshoot before final stability is attained, and a typical response oscillogram appeared as Fig. 3 of the earlier article already mentioned.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Motor Control Gear

IN his interesting article in the 24 November issue, Mr R. A. F. Craven makes clear the advantages of using direct-on-line started squirrel cage motors, particularly the smooth acceleration of the drive due to the absence of transitional peak change-over currents.

When, however, supply limitations make necessary some reduced voltage method of starting there is an alternative to the auto-transformer pattern operating on a 75% tap; and that is the *series* delta starter. This gives approximately the same starting performance (namely, about half the values obtainable with d.o.l. starting).

With this method, standard delta-wound motors are used, but the phase windings need to be centre-tapped. In compensation for this feature the starter has the simplicity, robustness and reasonable cost of the star-delta pattern; and yet makes possible a higher starting torque than is available from that pattern.

Perhaps this alternative might prove an attractive solution for marine applications.

A. N. D. Kerr, A.M.I.E.E.,
BRISTOL.

Distribution System Protection

I WAS very interested in the article by Mr G. Hall (24 November) giving details of a serious effort at simplifying the protection of transformers, with the attendant reductions in circuit-breakers needed.

One disadvantage of this scheme, which was mentioned, is that magnetising inrush currents can operate the low-set protection and it is therefore necessary for a link to be removed before energising a feeder. There is the attendant risk of forgetting about this link either before or after the switching. If the low-set element was self-

resetting and if the time delay was increased slightly, the protection would not respond to inrush currents and hence no withdrawal of trip links would be necessary.

The increase in time delay would mean that a low voltage fault not covered by fuses would persist longer than 0.4 sec as under the scheme mentioned. I take refuge behind the fact that such faults have a low frequency comparable to that of transformer faults.

E. G. Hopper, A.M.I.E.E.,
THURSO,
CAITHNESS.

* * *

THE low-set flag indicators mentioned by Mr Hopper have indeed operated when re-energising a network after shut-down, due to magnetising current inrush. This condition is only transient, however, and no danger of tripping exists. Mr Hopper's criticism is, therefore, not valid, and his proposals to increase the time delay are completely unnecessary.

G. Hall, A.M.I.E.E.,
LEEDS, 17.

Piezo-electric Ignition.—Use of a piezo-electric device to give the ignition spark for an internal combustion engine is demonstrated on the Trojan stand at the Smithfield Show. The unit occupies 3½ cu in. and weighs only ½ lb. The material used is a lead-zirconate-carbonate piezo-electric ceramic made by the US Clevite Corporation, whose British associates are Brush Crystal Co. of Southampton. The whole device has been called a "spark pump" and has two ceramic rods about ½ in. long with a small gap between them, in a plastics container. The rods are squeezed by a simple mechanism linked with the engine, and produce a voltage of about 20 kV. An important advantage of the device is that it produces a constant high voltage at all engine speeds.



Transformer developments

NOISE INQUIRY AND NEW CORE CUTTING PLANT

TRANSFORMER cores, it seems, are not the rigid structures they at first sight appear to be. In fact, they pulsate rather like well-fed boa constrictors. The impression of the complex vibrations produced by an alternating magnetic field is conveyed by a coloured colour film prepared by Ferranti research.

The film shows how single- and three-phase transformer cores would appear if their amplitude of vibration was increased 30,000 times. It is based upon accelerometer measurements made during investigations into the causes of former noise. Increasingly, transformers are located in up areas where noise can be objectionable.

Source of Noise

Investigations into noise show that it is caused by both longitudinal and transverse vibrations of core laminations. The longitudinal vibrations are caused by the own magnetostrictive effect, but the transverse vibrations are the result of interaction between the effects of magnetostriction, variations in core material property and design factors which result in flux transfer from plate to plate.

A transformer designer has little control over these although he can, to some extent, limit flux transfer between laminations. Prevention of noise generation requires much more fundamental knowledge of the properties of core steels and development of techniques for producing homogeneous materials. This is not likely to be achieved for some years. The designer must, therefore, resort to palliatives. For example, noise emission can be reduced by up to 35 dB with a suitable steel enclosure around a transformer, and in some cases anti-vibration springs can be used with success.

Backbone Core

Another approach to the problem of noise limitation has been attempted by Ferranti with their backbone core.



(page top), Relative values of longitudinal and transverse core vibrations, with the vibration amplitude greatly magnified. "II" from the Ferranti film, "Vibrations in Transformer Cores". A core plate being ejected from the front of the core press.

The investigations suggested that the nodal points of the vibrations producing noise are roughly in the centre of the core limbs. If the core was suspended at these nodes, transmission of vibration to the tank would be substantially reduced. The backbone core consists of a central vertical steel member with brackets at the nodal points. The core laminations are slotted and hung from these brackets and stiffener plates are then placed over the leg length. To reduce flux distortion, bolt holes are omitted from the core and it is held together by a number of steel bands encompassing both the limbs and yokes. During core assembly, the laminations are compressed hydraulically and the steel bands tightened to clamp the core and yokes firmly. Insulated inserts in each band prevent them acting as shorted turns. The construction also has mitred laminations to reduce cross flux. Although both iron loss and magnetising VA are reduced by this construction, the reduction in noise emission has been found to be disappointing, probably because the nodal points are not at all well defined.

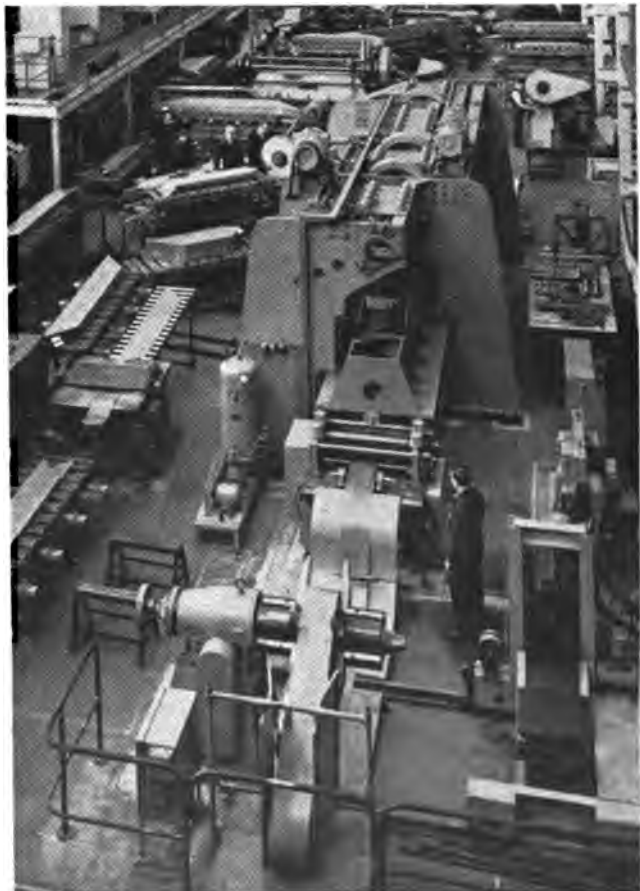


Fig. 3. This Ferranti core press can punch two plates 15 ft long simultaneously. Holes are punched with great accuracy with reference to the centre line reference on each plate.

During their research programme, Ferranti also investigated the use of a hard resin bonder of the Araldite family. It was found that, with the same core, noise actually increased after bonding. It was also found that increasing core compression does not necessarily reduce noise emission, although there did seem to be an optimum pressure to give best results.

Long-term improvements depend on better understanding of steel characteristics and obtaining more consistent values for magnetostriction, permeability and thickness—a nominal 0.014 in. thick sheet may vary between 0.011 in. and 0.018 in. In the short term, Ferranti have two investigations in hand, the building of two cores, one with very small magnetostriction and the other with uniform magnetostriction.

Although much remains to be done, it is comforting to learn that cold rolled steel probably does not behave any worse than hot rolled steel under the same magnetic conditions and also that no great economies in construction can be expected, even if ways of reducing the noise nuisance are found.

Automatic Core Press

While work continues on the theoretical problems of noise generation, the practical problem of producing large laminations from grain-oriented steel has been solved by installing a press with several unusual features. The press was developed by Ferranti and has been in operation since July. It can produce two core plates simultaneously with a maximum size of 15 ft by 47 in. at rates varying from 360 plates/hr to 480 plates/hr. To reduce inaccuracies, holes and slots are punched with reference to the centre line of the plates rather than one edge, and special features have been incorporated to give a punching accuracy to within 1/10,000 in.

Coils of cold rolled steel are first cut to the correct plate width on a rotary splitter. The roll is mounted on a motor-driven mandrell A (Fig. 4) and fed into the storage loop between

B and D. The motor is controlled by photo-electric cell and light beam C, C' to maintain sufficient material in the loop for a single press operation. Material is fed into the press by one group of the rolls D. The first operation, under hand control, is to mitre the sheet end with tool E₁ and, at the same time, to punch a series of holes with the tools F₁. When this operation is completed, the press is set to automatic control. The feed rolls D then feed the sheet forward at 200 ft/min until it interrupts a photo-electric cell at G, G'. The sheet speed then reduces to ½ ft/min. At H, the sheet strikes an accurately positioned micro-switch.

The feed rolls stop and a small punch is driven through the sheet at H and remains in position. A second set of rolls at D now runs in the reverse direction, tensioning the sheet against the punch and removing any ripples in the material. These rolls include an electro-magnetic slipping clutch. When the clutch begins to slip, a clamping device at D holds the sheet in tension and the press descends, punching simultaneously two core plates. The plates are ejected to the front and back of the press and the cycle is then repeated. The press also has provision for deburring the sides of the sheet.

All core plates are stacked automatically to have their punching burrs on one side. These are subsequently removed by a rotary grinder. The plates are then annealed in a nitrogen atmosphere furnace at 800°C and finally sprayed on one side with a kaolin coating which is subsequently baked.

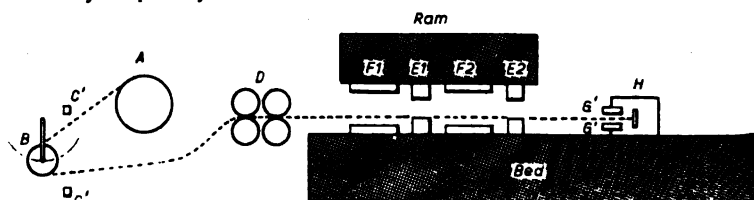


Fig. 4. Diagram of the core cutting machine. A, Unwind coil; B, Jockey roll; C, C', Photo-electric cell; D, Feed and reverse tension rolls; E, Mitre cutting tools; F, Punches; G, G', Photo-electric cell; H, Travel limit micro-switch

Corrosion in oil-fired boilers

THE results of trials made at Bromborough power station to find ways of suppressing acid deposits from power station flue gases are described in a paper presented to the Institute of Fuel yesterday.*

Burning residual fuel in power stations causes three principal difficulties: blockage of the air heater, corrosion of the air heater, ducts and dust-collecting plant and emission of acid-laden smuts from the stack.

Comparative trials of solid additives were made at the station and additional trials were made at Ince. Both stations burn residual fuel oil with between 2.9% and 3.4% sulphur content. The amount of sulphuric acid in the flue gas was greatly reduced by three additives: magnesium carbonate, a proprietary material, and zinc dust. Of these three,

magnesium carbonate was the cheapest, costing 8d/ton of fuel, the proprietary additive, 10d/ton, caused greatest fouling of the air heater, and zinc dust, 1s 7d/ton, fouled the burner air ports and interfered with combustion.

Experiments with both dual firing using a coal to oil ratio of 1:10 and also of pulverised fuel-ash injection caused severe fouling of the air heater by ash and sulphuric acid. The burners at Bromborough are of the steam atomising type while those at Ince are pressure atomised. Comparative tests showed no significant difference in the quantities of sulphur trioxide produced by these two types of burner.

The corrosion is caused by acid condensing on to cool surfaces. It would be possible to overcome the difficulty by increasing the temperature of the flue gases above the dewpoint or by reducing the sulphur trioxide content to a harmless level. The first method could result in a loss of thermal efficiency of as much as 1% and, in addition, would

probably increase acid emission from the stack.

The paper recommends that all oil-fired boilers should be operated with the minimum practicable amount of excess air to suppress the formation of sulphur trioxide. It also suggests future work on magnesium carbonate and zinc as additives, but says that more reliable methods of feeding into the furnace than that used in the trials are required.

The type of corrosion probe used during the trials gave very realistic data on the rate of corrosion of air heater surfaces and the measurement of air heater metal temperatures over the coolest region gave valuable information on gas-side fouling.

It was found during the trials that sulphur trioxide concentration was markedly dependent on excess air in the flue gas and that, contrary to previous published results, the percentage oxidation appeared to increase with sulphur content. No significant correlation between sulphur trioxide concentration and electrical dewpoint was found.

* "Acid Deposition in Oil-fired Boilers: Comparative Trials of Additives and Testing Techniques," by P. A. Alexander, R. S. Fielder, P. J. Jackson, E. Raask (all CERL) and T. B. Williams (CEGB).

AROUND THE TRADE

BY PEREGRIN

WITH Christmas only a fortnight away the pace quickens, the shop swarms with people, the gift type articles run out of stock, the phone buzzes, there are too many jobs chasing too few work—and in spite of the gloom, the rain and the credit squeeze, the month is off to a good start. November has good results for the smaller articles: the deposit for the new washing machine or refrigerator has diverted to buy a new kettle or a fitting for the room until finances become more steady. Refrigerators are not selling, but I am glad to see that Tricity broken away from conventional design with their refrigerator, the Diner-cold—it is such a refreshing change from the cold, clinical white enamel. I never understand why it was so essential to match the refrigerator to the lavatory basin rather than the furni-

Washing Machine Sales

Bendix and the English Electric Liberator appear to be the only washing machine selling at all. Hoover, and Parnall seem very dull in spite of their obvious efforts. I think Servis could do with altering their design; public taste now seems to be for plain, clean lines rather than the flamboyant. Their Super-Twin is a considerable improvement in this direction. Hoover's are getting a lot of money on very beautiful advertisements, I wonder whether a glossy coloured picture of a woman of giraffes really sells anything to the type of wife who does her own washing? A glossy coloured picture of a modern kitchen with a washing machine would do far more for all of us. But I would like to compliment them on their attractive display in their Tottenham Street shop. I notice it makes heads turn even on the bus—I wish I could say the same about the untidy front and rooftop of their Perivale factory, as seen from the railway. Surely they could transfer some of their nice coloured ideas to make it more attractive.

I appreciated the straightforward statement from the English Electric regarding their future sales policy and method of dealing with price reduction—this last the most important point to dealers—but I am not so satisfied with the new Bendix policy. Bendix have now left the direct-to-dealer group and are proposing to reduce their discount to 22½% and to take over all service.

From the reduction in discount, the dealer who relies on himself on good customer relations prefers to keep service in his own hands—the under-guarantee service will if he gets the right backing from the manufacturers. He has the trained men, the equipment, the stock and over years of experience behind him and, in many cases, the direct contract with the local laundrette. Now, presumably he is to hand over on a plate to Bendix the fruits of his labour and enterprise—they will be quite pleased to take over his trained staff as well! And why the discount? As prices tend to fall and purchase tax remains unchanged, overheads rise, profits are small enough as it is. In fact, it is the opinion of many people that eventually only dealers who can survive the rise in overheads will be those who own their own premises.

Grundig, the tape recorder manufacturers, are another of the direct-to-dealer-cut-discount enthusiasts. Well, there are more than plenty tape recorders on the market at 33½% discount and I, personally, feel that a manufacturer has to be a household name before he can afford to deviate from accepted practice and survive: although to reach that stage is becoming well-nigh impossible in these days of too many manufacturers making too many models.

I see that Flatleys are still favouring the full page advertisement including a list of stockists. Their washing machine page in the *Daily Mirror* was most effective—but why does it need the "Free Electricity for Life" gimmick? A good article backed by sound advertising should stand on its own without props of this kind. They are not really effective in boosting sales except, curiously enough, on a rising market. Then they may influence a customer to decide which machine she will have rather than whether she will buy one at all. At present there is no rising market.

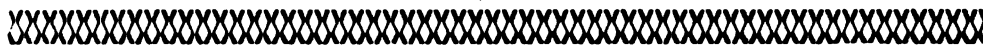
Incidentally, I think manufacturers could have second thoughts on tying up their washing machine advertisements with one particular brand of powder. Everyone does not use "Daz," and to associate it exclusively with one maker's machine is, in my opinion, bad publicity for that machine, although it may do a power of good for "Daz."

Sickness Pay

I notice that *The British Manufacturer* is running a two-part article on "Wages during unavoidable absence." It deals with the liability of employers to pay wages during periods of employees' absence through sickness and cites various cases where the issue has been settled in the courts in the employees' favour. Apparently, unless an employee is dismissed when he falls ill, the contract of employment persists and the employer is liable for the full amount of regular earnings plus any bonus or commission which he would have been likely to earn had he been at work. Further, it seems that the employer has no legal right to deduct the amount of sickness benefit. This could easily apply to hourly workers as well, it seems, and doubtless a worker in this class could succeed in an action against his employer, claiming a 42-hour pay week for all the time he was sick. Two things come out of this—that it would pay to be sick (as long as the doctor did not find you out) and that it is time employers took more notice of the form of contract under which they employ labour. The electricity boards have a definite scheme of up to 13 weeks' sick pay for their employees. Perhaps the NECTA might consider some similar form of contract. Some members may have cover in the form of insurance but not all are so well guided.

I end on a sad note—I have just seen the ECA Retail Brochure. It is very much the mixture as before! The only bright spot is the improvement in the jacket colour, but could the powers that be not take another look at the brochures issued by MK, Crabtree's and GEC and produce something better, even if it costs a little more? As it is, it is dull, quite dull.

OVERSEAS NEWS



from our correspondents abroad

CANADA

EHV Breaker Development

Development tests have recently been completed on air blast circuit-breakers designed by Canadian General Electric. The breakers use a common interrupter throughout the voltage range from 115 kV to 650 kV and are claimed by the company as suitable for operation at the highest voltages likely to be used in Canada in the future. The company had invested \$2 million in the five-year development and proving programme.

Newfoundland Electrification

On 16 Nov. electrification of the Trepassey Bay area was completed. The scheme has 1,400 miles of line, a power plant and brings power to seven settlements in the district.

Quebec Hydro Share Issue

The recent Quebec Hydro-electric \$40 million debenture issue received a favourable reception. It consisted of two maturities, five-year debentures maturing on 15 Dec., 1965, and 23-year bonds maturing 15 Dec., 1983.

Alberta Rural Loans

A further contribution by the Alberta Government to assist farmers in bringing electricity to their farms has increased the total loan since 1953 to \$32 million.

New Automatic Substation

An automatically controlled 15 MW transformer substation was brought into service recently at Repentigny in Quebec province. The substation steps down from 66 kV to 12 kV and supplies 2,300 consumers. At the substation opening, it was stated that growth in the Repentigny district had increased more rapidly than anywhere else in the Shawinigan Water and Power Co.'s system.

Nuclear Power Outlook

Disappointment was expressed by the Hon Robert Macauley, Ontario Minister of Energy Resources, that early predictions of nuclear power in Ontario had not been realised. Two stations were, however, under construction, a 20 MW demonstration plant and the 200 MW CANDU reactor near Lake Huron. He said it was expected that by 1980 nuclear energy would be supplying 7,000 MW. However, in the immediate future emphasis would be on construction of more thermal stations.

More Income for Gatineau

Results published by the Gatineau Power Co. for the nine months ending 30 Sept., 1960, show an increase in net income by 14% to \$3.5 million and an increase in gross revenue of nearly 10% to approximately \$15 million. The increase in revenue is attributed to continuing demand growth for electricity and also to sale of excess power as a result of better-than-average water conditions in the third quarter.

BRAZIL

Nuclear Plant Tenders

Tenders for a 200 MW nuclear energy plant to be built near Angra dos Reis are expected to be called in the very near future. This is reported to have been said by Sr Otavio Dias Caneiro, Director of the Mambucaba project. He said that tenders would be prepared by interested companies in the first half of next year and the selection would be made after July, 1961. Contracts would be signed early in 1962 and building should be finished in four years from that date. Estimated cost of the plant was American \$50 million.

WEST INDIES

Bahamas Electricity Demand Rise

During September, electricity generation by the Bahamas Electricity Corporation rose by 14.6% compared with the previous year to 6.5 million units. The number of consumers also rose by 9.2% to nearly 13,000 and the maximum demand was up by 16% to 12.2 MW.

Some vibration trouble experienced on the second of two turbo-generators installed at Clifton Pier station is reported to have been cured by adjustments to the bearings. This station has a design capacity of 10 MW but the output is at present restricted by capacity of the temporary circulating water system. A permanent installation will, it is hoped, be in operation shortly.

One Authority in Jamaica

The Jamaican Government consider that expansion of electricity in the island should be implemented by a single operator. In making this statement the Hon Wills O. Isaacs, Minister of Trade and Industry, said negotiations were

under way between the Government and the Jamaica Public Service Co. for a new licence to the company, covering the whole country. The Government would demand that the entire country was supplied with electricity. The frequency conversion scheme now under way would ensure that factories could be located with ease in various parts of the country. The Minister was speaking at the opening of the Savanna-la-Mar power station, reported in the *ELECTRICAL TIMES* for 1 Dec., for which the consultants were Messrs Ewbank and Partners Ltd.

EUROPE

Nuclear Station in Germany

The German Federal Republic's first nuclear power station came into operation recently. The station is sited near Kahl on the River Main and will be used mainly for test purposes. Built at a cost of about £3.5 million the reactor is owned by the Rhine-Westphalia Electricity Works and was constructed by AEG. Eventually, generation is anticipated to be 15 MW.

EGYPT

Belgian Firms "Sequestered"

Sequestration of the Belgian-controlled Egyptian Electricity Co. and the Cairo Tramway Co. was ordered by the United Arab Republic's Government last Thursday. The announcement put the total value of Belgian property to be taken over at £16 million, of which about £11 million is for the Heliopolis property company.

NORWAY

Development of Natural Resources

Relaxation of laws limiting foreign exploitation of Norway's natural resources has been recommended by a Government-appointed committee in a recent report. The law states that foreigners may only acquire water-course rights for hydro-electric development under special circumstances. The committee has recommended that the special circumstance clause be dropped. It feels that foreign and Norwegian concerns should be similarly regarded for development of natural resources.

committee's recommendations, a present regulation stipulating hydro-electric power plants not to the Government after could be dropped. A further requirement, that if the 35-year is not taken up the station any case revert free of charge, would also be modified to Government to sign further agreements with concessionaires. It is expected that the chairman and the board would be Norwegian.

or Tokke Scheme

World Bank has made a loan to \$25 million to Norway to assist in financing the Tokke hydro-electric development scheme. This is the largest hydro-electric in Norway, will consist of three units having a combined capacity of 1,700 MW; transmission lines will also connect networks serving central and western Norway and to connection with the Swedish power export of power. Ten companies in the United States are participating in the loan, without the Government's guarantee, to the extent of a bank loan of \$25 million in 1956 to help finance the first Tokke scheme.

Shortage for Generation

A shortage of water following a dry summer has provoked a power crisis in western and northern Norway. The Bergen power plant has chartered two tankers to transport supplies during the winter. The tanker has also been hired for use by power authorities at Lofoten and Varanger. The ship will produce 100 kWh/day at a cost of the five months.

GREECE

Acquisition

Athens-Piraeus Electricity Co.'s is to be acquired by Greece, having now been reached, it is expected last week-end. The undertaking to be taken over by the Public Corporation, the State-owned company responsible for electricity outside the capital area. The company will also take over certain long and medium-term indebtedness of the company, including the balance of credits granted in the UK to £2½ million. After allowing for the indebtedness, the price for the acquisition has been agreed at £10 million, this is after offsetting sums due to the Greek State for the company's contribution to the cost of the undertaking. The company's contribution for payment in sterling has been agreed that half the sum is to be paid before the undertaking is completed at the end of this year. The balance is payable in sterling over seven years at interest of 4%. Out of the total of £5,553,394 as the first £3,557,000 is payable to the

UK Treasury under settlement of its first mortgage debenture and interest. The largest interest in the Athens-Piraeus Electricity Co. is held by Whitehall Securities Corporation—one of the Cowi group of companies. We reported on 8 Sept. last that negotiations had started for the acquisition of the undertaking.

TURKEY

Generating Units Order

A contract for 103 diesel alternator sets for outlying petrol stations in Turkey has been placed with A. C. Morrison (Engineers) Ltd. They comprise Ruston air-cooled diesel engines driving Lyons 6 kW three-phase self-regulating and self-exciting alternators.

INDIA

Millionth Meter Manufactured

The millionth house service meter manufactured by REMCES of Bangalore was recently presented to the Mysore Chief Minister. Presentation was made by a senior director of the Japanese firm, Toshiba, who collaborate with REMCES. Toshiba have recently agreed to manufacture, in the Bangalore factory, meters, relays and permanent magnets. It was possible that they would also manufacture loudspeakers and transistorised radio receivers in the future.

Hydro-electric Survey in Karwar

Survey of hydro-electric resources at Kali Nadi has commenced in the Karwar district. This project is likely to meet the total power requirements in North Karnataka. The Mysore Government is also considering a proposal to construct new thermal stations. This was stated recently by the Chief Minister, Mr B. D. Jatti.

IEC Conference Ends

The international standards conference, which recently concluded its two week annual meeting in New Delhi, was attended by more than 400 delegates from 25 countries. Finalised IEC recommendations covered enamel wire, insulating materials and unification of certain electronic and switch components. Standardisation of electric motors, switchgear and control gear and instruments was also discussed.

Five-year Plan Progress

Some comparisons between the first and second Five-year plans were given recently in Lok Sabha by the Deputy Minister for Irrigation and Power. During the second plan period 2.4 million kW of plant was brought into service as against the target of 3.5 million kW at a cost of £307.5 million expenditure in the public sector, compared with the allocation of £320.25 million. Under the first Five-year plan period installed capacity rose by 1.1 million kW compared with the target of 1.3 million at a cost of £195 million, in the public sector.

Multan Station Tests

Operational tests began recently at the Multan power station in the Punjab. The station burns natural gas, obtained from Sui fields through a 350 km duct. The station was planned by Montecatini Sette Energia, who are also the operating concern.

PAKISTAN

Karachi Power Relief

Addition of 15 MW of generating capacity in the next three months with a further 66 MW by the middle of 1962 will, it is hoped, alleviate load shedding now essential in the areas supplied by the Karachi Electric Supply Corporation. Load requirements at present are running at 58 MW and load shedding has been necessary to bring the load down to 53 MW. The relief afforded by the 15 MW of new plant will not be immediately apparent, however, because overhauls are essential on two older sets which have been operating continuously since 1957.

AUSTRALIA

GEC Golden Jubilee

Fifty years ago the GEC subsidiary, British General Electric, was founded in Sydney. The company now has two works at Rosebury and Auburn and ten offices throughout Australia.

Open-cast Coal Dispute

The State Government of Western Australia is facing some opposition in re-allocating their coal contracts to include open-cast coal. Until recently, one company has been supplying between 25,000 and 35,000 tons of coal a fortnight at 48s 6d/ton. Under a contract which was to be concluded early in November, the same company was offered a contract for only 11,000 tons, but at the price of 55s 6d a ton. The company rejected the new contract. Two other collieries were offered contracts totalling 20,000 tons, 8,000 tons of which would come from open-cast mines. These two companies have accepted the Government's offer, but the open-cast mines are suffering from a strike by miners at Collie. The Southern Electricity Commission is one of the principal consumers of this coal and they had previously suggested that coal should continue to be supplied on the basis of the old contract.

NEW ZEALAND

Operation Statistics

New Zealand now has a total of 55 generating stations, of which 40 are hydro-electric. These have an installed capacity of 1,200 MW, or nearly 80% of the total installed generating capacity. This information is given in the annual statistics for the year ended 31 March, 1960. During the year, total generation was 6,360 million kWh and the number of consumers, 803,000, represented 34% of the population.

Personalities *in the industry*



Mr S. Fairclough



Mr T. E. Greenfield



Mr E. Broughton



Sir Gordon Radley



Mr W. E. Hind

Mr S. Fairclough, A.M.I.E.E., senior assistant commercial engineer (industrial) at No. 1 sub-area of the Merseyside and North Wales Electricity Board, has been promoted to commercial officer for the Board's No. 3 sub-area at Chester (*ESH, page 138). There, he succeeds **Mr R. M. Gravett**, M.I.E.E., who was recently appointed assistant chief commercial officer (industrial development). Mr Fairclough received his technical training at the Liverpool College of Technology and the Liverpool Corporation Electricity Supply Department. During the war he served overseas with the Royal Engineers, attaining the rank of captain. On his return to the supply industry in 1946 he held positions at Liverpool, St. Helens, Lancs, and later became district commercial engineer at Southport, prior to taking up his present position.

Mr T. E. Greenfield has been appointed sales development manager of the Industrial Process Control Division of Gresham Automation Ltd. Previously, he was with English Electric Aviation Ltd. as head of quality control for the production of guided weapons at their Stevenage works and was also test project engineer for the Thunderbird II. He started with J. Langham Thompson Ltd. in 1946, and three years later joined the General Electric Co. Ltd. at Stanmore, where he was concerned with flight instrumentation trials. In 1953, he returned to J. Langham Thompson Ltd. where he was general (technical) sales manager until 1957, when he joined English Electric Aviation Ltd.

Four recently retired top officers of the Hydro Electric Power Commission of Ontario have joined the Vancouver consulting engineering concern of CBA Engineering Ltd., who state that this strengthening is in the hope of participating in the Columbia River hydro-electric development. The four new members are: **Dr Richard L. Hearn**, former chairman of Ontario Hydro, who be-

comes president and a director of CBA; **Dr Otto Holden**, chief engineer of Ontario Hydro from 1955 until retiring last July, is to be CBA's senior consulting engineer; **Mr Gordon Mitchell**, who directed field construction on the St. Lawrence Seaway, will be in charge of CBA's construction contracts and programming and **Mr T. G. Willows**, formerly executive assistant to Ontario Hydro's chief engineer, becomes project manager for CBA.

Manager (designate) of the West Wales area of the South Wales Electricity Board is **Mr E. Broughton**, A.M.I.E.E., at present manager of the Board's Rhondda district. Mr Broughton will succeed **Mr W. E. Richardson**, the present West Wales area manager, who, as already announced, is to take over management of the Board's Monmouthshire and Mid-Wales area on 1 March next. (*ESH, pages 130, 132.) Mr Broughton, who is 52 years of age, has held his Rhondda district appointment since December, 1958. He joined the supply industry in 1925 as a trainee with the Rochdale Corporation Electricity Department and later served with the Southport Corporation Electricity Department and Altrincham Electric Supply Ltd. In January, 1949, he became district engineer of the south west district of the North Western Electricity Board, held that post until March, 1954, when he was appointed construction, operation and maintenance engineer for the Mid-Sussex sub-area of the South Eastern EB. (*ESH, pages 130, 132.)

Mr J. P. Featherstone, who has been director of home sales for J. I. Case Co. Ltd., since its formation on 1 Jan. this year, has been appointed to the board of directors.

At the recent annual general meeting of the Junior Institution of Engineers, **Mr E. E. Burrage**, M.I.MAR.E., was elected chairman.

Sir Gordon Radley, K.C.B., C.B.E., PH.D., M.I.E.E., has been elected a director of the English Electric Co. Ltd. Sir Gordon retired last May from the position of

Director-General of the GPO and it was announced in July that he would devote part of his time to work with the English Electric group of companies, particularly in the development of telecommunications equipment for world markets. He was then elected a director of three subsidiaries, Marconi's Wireless Telegraph Co., Marconi Instruments Ltd. and the English Electric Valve Co., and to the board of the associated concern, Marconi International Marine Communication Co. Ltd.

As we briefly noted last week, **Mr W. E. Hind** has been promoted to manager (home sales) to British Insulated Callender's Cables Ltd. He was formerly deputy manager (home sales), having joined the former Callender's Cable Co. in 1920. In his new position, Mr Hind's responsibilities cover all aspects of the selling activities of the company at home, including matters of publicity, public relations, exhibitions and display, and market research. He is a past-chairman of the Rubber and Thermoplastic Cable Manufacturers' Association.

Gold badges, the highest awards for long and distinguished service by members of the top management of the member companies of the International Electrolux organisation were presented to **Mr M. Aitken**, secretary, and **Mr G. L. Hughes**, technical manager of Electrolux Ltd., at the company's annual sales dinner and dance in London recently. Mr Aitken, who joined Electrolux Ltd. 34 years ago, has been secretary of the company for the past 13 years and Mr Hughes, who joined the firm 30 years ago, has been technical manager for 13 years. In addition to these special awards, Sir Harold Wernher, chairman, presented gifts and certificates to 28 employees who had completed 25 years' continuous service with the company.

After 40 years' service in the electricity supply industry in the Midlands, **Mr E. J. James**, a member of the engineering staff of the Midlands Electricity Board,

* Denotes revision to the "Electricity Supply Handbook, 1960."

a few days ago, aged 67. He with the Shropshire, Worcester and Staffordshire Electric Power 1920 as construction engineer and in progressive appointments until 1931 he was loaned to the Kirtlington County Council to plan the transmission and distribution system, his scheme being adopted in 1931. Since 1948, Mr James has been member of the engineering staff at headquarters, serving from 1949 as head of the development, design and operation section; from 1 March, 1959, as acting deputy engineer and, subsequently, carrying out special engineering duties.

Mr James was appointed to the board of the company in 1959. He is Mr James. Previously acting general manager at the Willesden works of the company, he is confirmed in that position as successor to the late Mr C. F. James. Mr D. W. Malim has been elected director and general manager of the company's Trafford Park works.

Mr K. Dolman, A.M.I.E.E., has been elected sub-area commercial officer for the Harrogate sub-area of the North Yorkshire Electricity Board to succeed Mr H. Hind, who will retire from that post at the end of this month (*ESH, 53). Mr Dolman is at present assistant engineer in the commercial officer's department at Harrogate.

Mr James was appointed deputy managing director of the company in 1959. He is Mr James. Mr J. A. Mason, M.A., M.I.E.E., formerly the commercial director (production). Mr F. O. James, B.Sc., M.I.E.E., formerly director (production) is to succeed Mr Mason as deputy managing director (production). Mr Mason trained at the company as a director of the firm in 1950. Mr Morrell became director (production) of the company after being director of research for British Telecommunications Research Ltd. from 1949. Previously he was with the Post Office Engineering Department.

Mr C. Scott has been elected to the boards of Cossor Radar and Electronics and Cossor Instruments. Mr J. S. James has been elected to the boards of Communications Co., Lea Bridge Works, and Best Products, and Mr P. Wood has resigned from the board of Cossor Communications Co. Mr N. Elson, who is technical director, also becomes general manager.

Mr James has been elected to the board of Westool Ltd. Mr D. Riddell, who is chief engineer, Mr D. L. Shand, the works manager, and Mr A. G. Why, secretary and accountant. Mr Riddell joined the company as research engineer in 1946 and was appointed to his present position in 1954. Mr Shand has been works manager since 1958, and Mr Why first joined the company in January, 1959. It is announced that Mr G. R. Hook has resigned from the board after 41 years in the company, during which he was 35 years managing director. He

was responsible during the war for an extensive programme of development and manufacture for the Admiralty and Ministry of Supply.

Mr D. Craggs has been appointed production manager at the Ekco Radio factory at Kenway, Southend-on-Sea, succeeding Mr J. D. Brown, who is taking up an appointment with AEI. Mr Craggs, who has been with E. K. Cole Ltd. since 1937, was previously assistant production manager at the Ekco television assembly factory at Southend.

Mr D. M. Patten, A.M.I.E.E., has been appointed deputy station superintendent at Uskmouth "A" power station, South Wales Division, CEBG, in succession to Mr P. E. Dickinson, A.M.I.E.E., A.M.I.MECH.E., who has taken over a similar post at Uskmouth "B." Mr Patten was previously deputy station superintendent at Doncaster and had earlier served at Battersea, Plymouth "B" and Portishead "B" power stations.

After 21 years' service as secretary of B. S. and W. Whiteley Ltd., Mr L. Musgrave, F.C.A., retired at the end of November. He is succeeded by Mr E. M. D. McEwan, F.C.I.S., who has been assistant secretary for the past ten years.

Three promotions in their Transmission Project Group at headquarters are announced by the CEBG. Mr B. St. M. F. Webb-Ware, M.A., A.M.I.E.E., becomes assistant chief transmission project engineer; Mr D. M. Porter is appointed administrative officer to the Transmission Project Group and Mr H. V. Flaxman becomes engineer-in-charge of the drawing office at that Group (*ESH, page 48). Mr Webb-Ware, who has been co-ordinating engineer (specifications and contracts) in the Transmission Construction Branch at CEBG headquarters since March, 1948, was educated at Rugby and Trinity College, Cambridge, and spent two years as a student apprentice with A. Reyrolle and Co. This was followed by an appointment as an assistant engineer in the Technical and Research, Switchgear Design and Erection Departments of the same company. Between 1934 and 1938 he was a technical assistant in the south east England office of the Central Electricity Board. His first appointment in the headquarters of the CEB was as an assistant engineer in the System Operations Department, a position he held until 1941, when he

became assistant construction and contracts engineer. Mr Porter was educated at Haileybury and after an early career in banking and accountancy he joined the Chief Accountant's Department of the CEB in August, 1932. From then until the outbreak of war he was engaged successively on the framing of the first bulk supply tariffs, internal audit and capital expenditure. During the war he spent five years in the RNV. Returning to the CEB in 1946, he became an assistant chief accountant in 1952 and an assistant chief financial officer in 1958, which position he has relinquished to take up his new appointment. Mr Flaxman, who was educated in Leeds, served his Articles with consulting engineers. He spent a number of years as a draughtsman and site engineer with private concerns before joining the CEB in 1946 as an engineering assistant in the drawing office. From this post he was promoted to senior section leader and later to second-in-command at headquarters drawing office, the position he has vacated to take up his new appointment.

Mr S. A. Clodd, executive director, E. K. Cole Ltd., has been elected chairman of the Industrial Section of Southend-on-Sea Chamber of Trade. The new vice-chairman is Mr R. R. Laird, Ekco personnel manager.

Mr C. E. Walker has been appointed sales manager of Philco (Gt. Britain) Ltd.

Chief Press Officer of EDA, Mr John M. Fraser is making a satisfactory recovery after an operation for the removal of toes at Farnborough Hospital, Kent, we are glad to report. Mr Fraser is suffering from sugar diabetes, and at one time there was a risk that he might lose a leg, but this is now unlikely, we understand, although it will be some little time before he leaves hospital.

After 41 years' service with the Associated Electrical Industries Ltd.'s Rugby Construction Department, Mr J. Stronach, a native of Dunfermline, has retired. Mr Stronach served his apprenticeship with J. and G. Marshall, Dunfermline, later joining John Brown and Co., of Clydebank, until 1915 when he joined the Merchant Navy as an engineer. After the war he was with Balfour, Beatty and Co. for a year, and joined the BTH Construction Department in Scotland in 1919. From 1925 onwards he spent most of his time in the London district. He took



Mr D. Riddell



Mr D. L. Shand



Mr A. G. Why

charge of several large turbine contracts in the London area, subsequently becoming assistant to the district engineer, Mr J. W. Turner, on whose retirement in 1947 he was appointed district turbine construction engineer for the London area.

General manager of the GEC Engineering Works at Witton from 1 Jan. next will be **Mr T. H. Kelsey**, M.A., M.I.E.E., at present deputy general manager. **Mr W. D. Morton**, M.A., A.M.I.E.E., A.M.I.MECH.E., manager of GEC Traction Division, is to become assistant general manager at the works. This change follows the retirement of **Mr J. J. Gracie** at the end of December.

Mr G. W. Bone having intimated his wish not to continue as joint managing director of Ruston and Hornsby Ltd. after 31 Dec., 1960, **Mr V. R. Prehn** is to continue as sole managing director until 31 Dec., 1961. From 1 Jan., 1961, **Mr C. T. Alderson** (assistant managing director) is to be appointed deputy managing director with the intention that he should succeed Mr Prehn as managing director by 31 Dec., 1961. Mr Bone will continue as managing director of Ruston's associate company, Davey, Paxman and Co., and become vice-chairman of Ruston and Hornsby.

Previously assistant sales manager of the MO Valve Co. Ltd. (subsidiary of the GEC), **Dr W. E. Rowlands** has joined Walmore Electronics Ltd. as sales manager.

Sir Howard Florey has been elected president of the Royal Society in succession to **Sir Cyril Hinshelwood**. The new treasurer of the Society is **Sir Alexander Fleck**, K.B.E., and **Sir Patrick Linstead**, C.B.E., Rector of the Imperial College of Science and Technology, has been elected foreign secretary. Among the new members of the council are: **Prof J. F. Baker**, O.B.E., Professor of Mechanical Sciences, Cambridge University; **Sir Alfred Pugsley**, O.B.E., Professor of Civil Engineering, Bristol University; and **Sir Gordon Sutherland**, Director of the National Physical Laboratory.

Engineer of the Enfield district of the Eastern Electricity Board since 1948, **Mr S. M. Lejeune**, A.M.I.E.E., is going to the Board's Chilterns sub-area as the engineering senior assistant, planning and development (*ESH, page 110). Mr Lejeune started with the Hendon Electric Supply Co. in 1921, and after three years joined the BTH Co. at Willesden. Following five years' general works' experience, including the development of protection gear, he joined the North Metropolitan Electric Power Supply Co. at Enfield as a junior engineer in 1929.

Chairman of Bowthorpe Holdings Ltd., **Mr J. Bowthorpe** has just returned to this country from a 69-day world tour. His son, **Mr Peter Bowthorpe**, who travelled to Australia with him, has remained in the United States to take up an appointment with the group's subsidiary in New York—Hellermann Corporation—for a two-year period.

OBITUARY

Mr J. W. J. Townley, C.B.E., M.I.E.E., formerly manager of the North Eastern sub-area of the London Electricity



Mr J. W. J. Townley

Board, and ex-West Ham chief, died on 29 Nov., aged 75. Mr Townley retired from LEB service at the end of March, 1953, but he was probably best known for his 18 years' work as borough electrical engineer and manager at West Ham prior to vesting day. There he was responsible for many innovations which brought rapid electrical development, and he was also primarily responsible for the construction of the West Ham "B" power station. He was awarded the C.B.E. for his work in improvising supplies during the air raids, in which West Ham suffered severely. Born in Scotland, Mr Townley gained experience with electricity undertakings at Paisley, Manchester, Ashton, Sunderland, Barnsley and Bradford (where he was deputy city electrical engineer) prior to serving as chief electrical engineer to LCC Tramways from 1927 to 1929, when he went to West Ham.

Mr Alexander Kelso, M.I.E.E., manager of the Glasgow area of the South of Scotland Electricity Board, died on 28 Nov., aged 62. A native of Fife, Mr

Kelso flew in the first world war the Royal Flying Corps. After entering the electricity supply and was for a number of years Fife Electric Power Co. In 1915 transferred to Harrogate and became borough electrical engineer manager there. He served in that position until 1948 when he was appointed the position he held at the time of his death.

Mr F. Shapley, assistant British Engine Boiler and Electrical Insurance Co. Ltd., Manchester, died on 27 Nov.

Mr J. D. Spark, M.I.E.E., former electrical engineer and manager of the Lesden Corporation, died on 2 Dec. 1960. He started his career with the Corporation Electricity Department after a period with the North Electric Light and Power Co. as a distribution engineer at Cronin, and distribution engineer at Swansea for two years, before Willesden where he was deputy engineer for 14 years prior to becoming chief.

Mrs M. E. Vallance, a daughter of Vallance and Davison, electrical radio dealers, of Bradford, and the managing director of that firm, died on 27 Nov.

Mr J. R. Spanswick, B.Sc., M.I.E.E., M.I.MECH.E., manager Thermal Process Section, Metallurgy Division of the English Electric Ltd., died on 4 Dec., aged 49, having joined English Electric in 1951 with the Electric Furnace Co. for 18 years.

CEGB Plans 400 kV Transmission

NEXT step in transmission voltage for the CEGB is 400 kV, not 380 kV as originally planned. The change is to be accompanied by use of four-conductor bundles which will increase carrying capacity for a double-circuit line to 3,000 MW, against the 1,200 MW capacity accorded to a standard 275 kV line today, using 0.4 sq in. double-conductor bundles.

In announcing the decision to make this change, the CEGB recall that the majority of existing 275 kV supergrid lines were designed with an eye to future conversion to 380 kV. The plan now is to re-insulate them when the change becomes appropriate for operation at 400 kV. This change, with the two-conductor bundle retained, and only the insulators changed, will give an increase in transmission capacity to 2,000 MW for a double-circuit line.

So far there have been no practical trials even with 380 kV. The existing position is that equipment has been ordered for a 380 kV experimental line between Monk Fryston and High Marnham, which is due to come into service in 1962. However, the CEGB feel that knowledge of technology is far enough advanced to permit orders for 400 kV

equipment to be placed in the market without waiting for the trials.

The first 400 kV line should be in commercial service in 1962. From then on, the new voltages will be introduced gradually to meet growing demand.

For the 3,000 MW lines, a new type of tower will be introduced, 20% taller than the existing 275 kV tower, but of course considerably heavier, but with the greater mechanical strength. This tower will be strung with four conductor bundles, each made of 0.4 sq in. copper equivalent aluminium conductors, the same as those used for the 275 kV lines. The difference between the rating of these lines (50% greater than the two-conductor bundle) and the increase in conductor material that for a two-conductor bundle is accounted for by system stability considerations, which usually make it possible to use the full thermal capacity of overhead line conductors.

The CEGB state that studies have shown that there is no great advantage to be gained in the use of the 400 kV voltage. This is in amenity, because fewer towers will be required.

Transformers in court

THREE-YEAR PRICE REVISION. ONLY ONE YEAR'S WORK ON FACTORY ORDER BOOKS. PLAN TO EXTEND T.M.A. FAILED

WITNESSES called by the Transformer Manufacturers' Association are continuing to give evidence before the Restrictive Practices Court. As we said last week, the second witness for the Association, M. Hobill (general manager, Transformer Department, Ferranti Ltd.) supported the argument that loss of the Association's home price agreement would make the agreement ineffective. He said the only reason for delay in obtaining orders in the export market was the "ridiculously low prices" Continental competitors were getting in foreign markets. Continental manufacturers' prices were low because they had excess capacity and were cutting prices to keep their factories occupied. Looking at Ferranti's order book, Mr Hobill said the value of unexecuted orders in his department at present was equivalent to about one year's work, or an output of £5 million. Bearing in mind that some transformers were ordered for delivery two or three years ahead, he said they were on very thin ice. He thought suggestions that the object of the agreement was to ensure stability of price were true, but that was by no means the only object of the agreement. The endeavour of members of the Association had to be to ensure stability of price, no matter what market conditions might be.

Hobill explained how the Association fixed prices. The price was fixed by the average of the three lowest prices of the seven members. It might be a fraction better than the lowest cost and probably a little better than that for the third lowest cost. But, taking the average as a whole, it certainly represented an extremely low price. This meant it offered an incentive to increase efficiency, because members showing higher costs had to prove their efficiency to achieve a reasonable profit. (It had been explained earlier in the case that the price fixed by this method might be further reduced by a "selling factor" taking account of competition from outside the Association.)

Under cross-examination, Mr Hobill suggested that the price agreement could not possibly be retained if the agreement was abandoned. He agreed that as long as domestic prices were higher than export prices, Association

members would not be anxious to seek for export orders; but if for the purposes of increasing exports, prices in the home market were cut even more drastically, the industry would go out of business. If price-cutting competition began because the agreement was ended, reduction of quality would be brought about eventually from the sheer economic pressure of a small profit margin.

Commenting on a suggestion that the Association had kept up prices where it would have been proper and reasonable to reduce them, Mr Hobill said he did not think the Association had taken unfair advantage of the circumstances. Object of the Association was to maintain prices and maintain profit levels. Occasions when it had kept up prices were "fairly isolated." They involved using the agreement against the pressure of a buyer.

In re-examination, Mr Hobill said that during the past 12 months transformer prices in the USA had fallen by about 30%. He was succeeded as a witness by Mr A. R. Kevan, who is responsible for the Sales Tender Office of the Transformer Tendering Department of the English Electric Company. Mr Kevan explained the basis of costing of various types of transformer. He said that the Association's intention was to effect a re-costing, giving new price schedules, about once every three years.

New Members Sought

Mr Kevan told of a meeting held last June at which the five largest manufacturers of transformers, not members of the Association, met representatives of manufacturers who were members, to discuss the possibility of their joining the Association. He agreed that the idea was that if the five firms had been willing to join, the TMA might have reduced prices for transformers up to 200 kVA rating to be around the level of labour and material costs, so as to drive out of business non-members of the Association. Prices for larger transformers would have been raised to give a reasonable profit margin.

Mr Kevan said that correspondence had shown that the "independent" manufacturers would turn down the proposal before the meeting was held. The Leeds meeting was not discussed with members of the Association beforehand. He and others attended the meeting as individual manufacturers, not as members and officers of the TMA.

Under further questioning, Mr Kevan said he went to the Leeds meeting "with an open mind and dubious of what might come out of it." He did not think the Association management would disapprove of price leadership with pressure vested in the Association, even though that involved increasing or reducing prices collectively to deal with competition from non-members.

Later Mr Kevan was asked if certain documents showed any consideration of the public interest. He replied that he had not yet seen a definition of what was the public interest. His own interpretation was, a fair return in payment for a fair price. He thought the interests of the public were served by profit levels being maintained.

The case so far . . .

The ten-member Transformer Manufacturers' Association is defending before the Restrictive Practices Court its agreement providing minimum prices for transformers sold for use in the UK. In the opening statement on behalf of the Association, much was made of the need to have such an agreement if there was to be a parallel agreement for co-operation in the export field. The need to co-operate as a source of strength in bargaining with the supply industry was also stressed. Witnesses for the Association have drawn attention to under-employment of the capacity of the industry at present and have underlined its difficulties in selling overseas. The case began on Monday, 21 November, and will last several weeks.

main highways. This is not so when considering side roads and public thoroughfares and is a reason why the time-honoured tungsten lamp has held its own for so long in this application against more economical discharge lamps of the type already mentioned. The introduction of the colour-corrected mercury-vapour lamp presents a challenge to the tungsten lamp, although initial cost is higher and its bluish-white colour rendering not quite so satisfactory. Normal indoor-type fluorescent lamps are also being used, although their length tends to make the outdoor lanterns expensive.

Public Thoroughfares

A particular problem in lighting shopping thoroughfares and other public places, is the importance of eliminating or reducing the number of support columns and thus to free pedestrians and other traffic from unnecessary obstructions. One method is to mount lanterns on the walls of shopfronts as in the case of a high-street installation quoted, which uses 140 W discharge lamps at a height of 25 ft with 40 ft opposite spacing. Illumination produced is 20,000 lumens/100 linear ft. Another solution is that which has been applied to the illumination of an open city square in Munich. Here, a lantern weighing 1.2 tons and made up of three 20 kW xenon lamps and six colour-corrected mercury-vapour lamps, is mounted on top of a single 100 ft pole. It lights an area of about 55,000 sq ft, which is illustrated by Fig. 2.

While, as is implied in the paper, there is a realisation that British street lighting is not all it could be, both in quality and extent, there is general reluctance on the part of public authorities to spend money on improvements. Although a good deal of pioneering work has been carried



Fig. 2. City square in Munich lit by 1.7 million lumens from 63 kW lantern

out by the Road Research Laboratory, local engineers seem to be slow, compared with their temporaries abroad, to seek or adopt unconventional methods of solving problems. The authors conclude a plea for not only improvement in illumination of existing roads, but extension to the new motorway installation cost of motorway lighting, which is £2,000 to £3,000 per mile for a single carriageway, represents only 2% to 3% of the total cost of the road. In addition, there is a running cost of £700 per annum; even so, it has been estimated that the decrease in accident rate would easily justify the

DISCUSSION

Opening the discussion, Dr J. W. T. WALSH, NPL (retired), agreed that British street lighting was dominated by the pre-war code of practice, which was laid down in 1937. It should be borne in mind that this was formulated not only in relation to road surfaces existing at that time, but also to the cost of light, which was 20 times what it is today. He was glad that the authors had emphasised the importance of spacing/height ratio in installation design, but added that street width was also important in determining lantern mounting height. Speaking of optimum spacing/height ratios he pointed out that a value of 4:1 had been put forward as long ago as 1892. In conclusion, he endorsed the authors' view that the problem of improvement was not technical but mainly financial, due to the anomalies of local administration. There was, he said, an extraordinary multiplicity of lighting standards in operation throughout the country which had to be rationalised before any further progress could be made.

Challenging the figures of the poll quoted by the authors concerning glare from sodium and mercury-vapour lamps, Mr H. R. RUFF, AEI, said that results of such tests depended a great deal on luminous intensity of the light sources and the effect of background illumination pertaining under practical conditions. Disagreeing with the authors, he said that high-angle beam lanterns were no longer used to any great extent in

this country. On the other hand, lip service was paid to medium-angle lanterns because of their reputed economy. He went on to say that he considered that the 70° cut-off lantern offered the best compromise for present conditions.

Mr H. JACKSON, South Wales Electricity Board, considered that the costs quoted for single carriageway main highway lighting were reasonable. He compared these with a dual-carriageway installation near Cardiff costing £11,700 for 1.93 miles. This used medium-angle lanterns with sodium-vapour lamps having 4.5:1 spacing/height ratio. It gave very satisfactory results with an illumination value of 9,600 lumens/100 lin ft. Judging from the performance of this particular installation, of which he had personal experience as a motorist, Mr Jackson thought that the maximum figure of 20,000 lumens/lin ft specified by the authors might be a bit on the high side.

Mr F. C. SMITH, defending public lighting engineers, said that they were very much alive to the lighting requirements demanded by present-day conditions and the urgency of the problem in view of the growing accident rate. He reiterated the authors' statement that Class A lighting on main roads could cut down accidents by as much as 30%. He praised the efforts of "back-room boys" for progress made in the efficiency of light sources, providing the means for improvement of installations.

Mr S. S. BEGGS endorsed other

speakers in saying that good could not be obtained without for it. Considering the efficiency of skid surfaces, he said that a frictional force coefficient of quite good enough for road purposes, while it gave a factor of half that of pre-war. This seemed to be a good compromise.

Mr H. M. FERGUSON, replying in discussion, said that Dr Walsh's reference to spacing/height ratio was an illustration of the present main street lighting.

There were at the present many lighting authorities in the country that if each of the existing authorities and the potential authorities were to put up a single lighting lantern—to the code of practice, one would hope—the in which would result would extend from London to York. That was a solution of the problem with which the country was confronted. He decrying the efforts that were being made by the lighting authorities. On the contrary, he sometimes wondered was that they did so well in such circumstances. He emphasised what was wanted was uniformity of lighting rather than uniformity of light source. Indeed, they did particularly want to have uniformity of type of light source or the type of distribution. Variety was the spice of life even in street lighting, provided it was kept within reason.

Electronic telephoning

I.E.E. CONFERENCE ON EXPERIMENTAL EXCHANGE

TELEPHONE engineers from many countries attended an IEE conference, held last month, on the subject of electronic telephone exchanges. The idea of replacing the moving parts of the conventional electro-mechanical exchange by static electronic equipment has many attractions, and the Post Office plans to bring into operation within the next two years an experimental exchange at Highgate Wood, North London. Many of the papers presented at the conference were concerned with this and these form the basis for this article.

Highgate Wood will make use of the idea of time separation rather than space separation between different calls. The central electronic apparatus will be common to all calls, instead of there being a separate conductor path through the exchange for each call, as in a conventional exchange. The technique used is "time division multiplex" (t.d.m.), well known in telecommunication engineering but not previously applied to a public telephone exchange.

As applied at Highgate Wood, t.d.m. involves sampling the incoming audio frequency signal from a speaking subscriber at a repetition rate of 10 kc/s and using the amplitude to modulate a pulse of 0.8 microsecond duration which occurs in a pulse time of 1 microsecond allocated to each channel. Fig. 1 shows the principle adopted. Pulses are repeated every 100 microseconds. Terminating equipment for each line at the exchange includes modulating circuits and demodulating circuits which extract the audio component from pulses and amplify it before passing it out of the exchange.

Within the exchange, each connection is in four-wire form, two wires for each direction of speech between two subscribers. Connection of two lines is arranged by providing that they are connected only at the times appropriate to the channels (i.e., pulse times) that have been allocated to them. This is secured by applying the appropriate channel pulses to "gating circuits," which otherwise block the output from particular subscribers.

For electronic reasons, it is arranged that the circuit in one direction is opened 50 microseconds after the circuit in the other direction; so two channels are occupied by any one call. One hundred microsecond magnetostrictive delay lines control the gates, and they are centre-tapped to give the required 50 microsecond separation.

Highgate Wood

Highgate Wood will have facilities for 3,200 lines (subscribers plus junctions from other exchanges, etc.). There will be four groups of 800 lines, each having access to 100 channels. Each group of 800 lines connects to a pair of highways. Provision is made for connecting groups of lines through pulse-operated gates, as shown in Fig. 2.

A rotating magnetic drum storage system is used for setting up a call, from the initial receipt of dialling pulses to the finding of the required subscriber or the necessary connection to another exchange.

Magnetic drums carry information about each exchange subscriber, covering points such as directory number,

physical connection to exchange, whether the line is "busy," and many related details, such as whether a number is one of several on a p.b.x. exchange. The drum is scanned for one complete revolution to find whether a calling subscriber should be connected or given a number engaged or number unobtainable signal. Information from it is then used for setting up the call if this is possible.

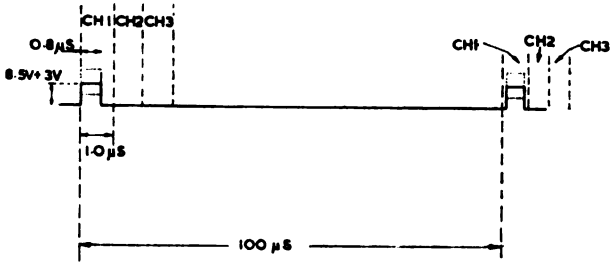


Fig. 1. Channel pulsing for t.d.m. system. Pulses have mean amplitude 8.5 V with maximum modulation ± 3 V

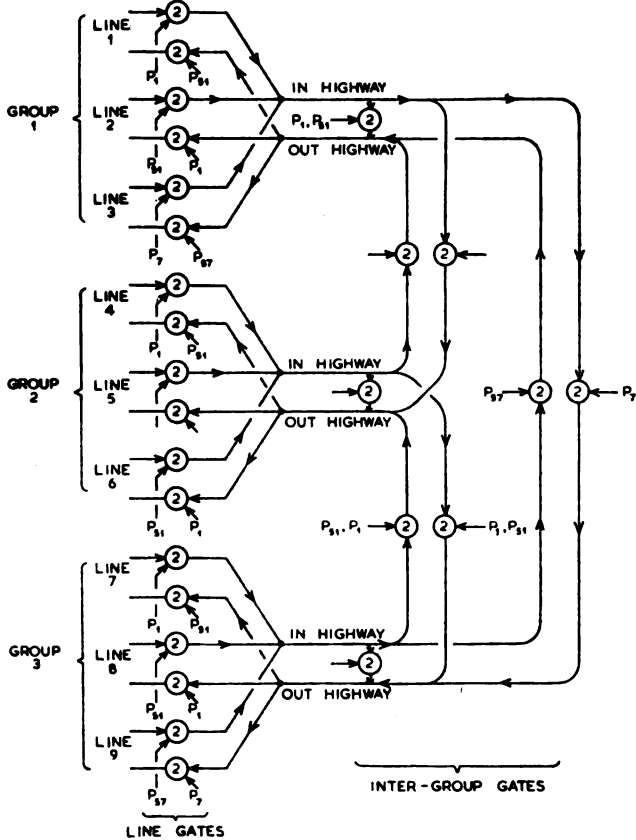


Fig. 2. Speech interconnection on t.d.m. system. Pulses at 50 microsecond intervals effect connections as shown. Note how inter-highway and inter-group gates permit one channel to be used several times. Lines connected are 1-2, 3-9, 4-8, 6-7

equipment for industry

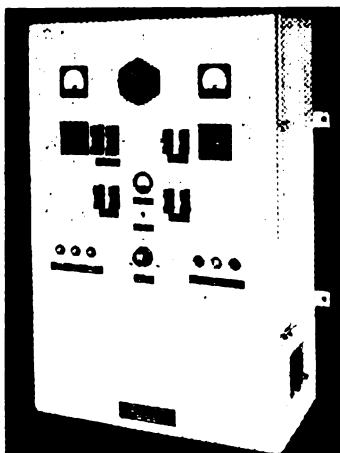
Alkathene prices cut

RECENTLY the price of Alkathene was cut by 4d/lb to 1s 10d/lb. This fourth price reduction represents a total of 33% over the last two years and has been made possible by increased use of polythene. *Imperial Chemical Industries Ltd., Imperial Chemical Hse, Millbank.*

Standby diesel control

AUTOMATIC start-up and shut-down for a standby diesel generator is accomplished with the "Sicon" mains failure control panel recently introduced. The panel is said to be suitable for emergency standby supplies for hospitals and communications systems. If a supply failure occurs, the panel isolates the mains from the load, applies a starting signal to the diesel engine and, when the correct system voltage has been attained, connects the alternator to the load. When mains voltage is restored the panel disconnects the alternator and shuts down the diesel. Provision is included on the panel for routine testing of the diesel and various alarms are provided.

Two other products have also recently been introduced by the same company. They are a counter with a range from 0.1 c/s to 120 kc/s and a switching panel. Special features of the counter are its very high input impedance and a latching system which retains a count while a subsequent count is in progress and only changes the display if, at the end of the counting period, there is a discrepancy between the two. Easy reading is ensured by using a digital display on projecting indicators which have a black background. The instrument incorporates a crystal clock which allows time intervals between 0.1 millisecc and 10 sec to be measured.



► This Efco quench furnace for small batch production has 15 kW heating elements and a circulatory fan driven by a water-cooled motor

◄ One of the 21 new products introduced this year by Southern Instruments is this "Sicon" diesel control panel for starting-up and shutting-down emergency standby generator sets

The switching panel is designed for use with the Southern FM System and enables outputs from up to four oscillators to be displayed on an oscillograph. The panel is for use in conjunction with oscillators controlled by single capacitance or inductance types of transducer. The switching controls permit reversal of signal polarity and also independent adjustment of each channel amplitude so that any transducer signal can be displayed without readjustment of the controls. *Southern Instruments Ltd., Frimley Rd, Camberley, Surrey.*

Boiler feed analysis for silica

ACCURATE knowledge of the quantity of silica in boiler-feed water becomes of increasing importance for high-pressure boilers operating above 900°F. Above this temperature silica volatilises and may form deposits on turbine blades and other items of equipment. An instrument for accurate assessment of the concentration of silica in feed water has recently been introduced. Essentially, it is a colorimeter which compares the colour of treated feed water with a reference. Silica concentration is revealed by adding two solutions to a feed water sample, which then becomes blue in colour. The silica analyser is claimed to make an analysis in 12 minutes and is available in three ranges for 0.02 parts/million to 0.30 parts/million. Detection of the colour difference between the feed water and the reference is by a photo-electric cell feeding a transistor amplifier. An accuracy of $\pm 5\%$ f.s.d. is claimed and calibration is said to be simple. The instrument is housed in a glass fibre cabinet measuring 34 in. by 17.5 in. by 12 in. *Electronic Instruments Ltd., Richmond, Surrey.*

Emergency stop button

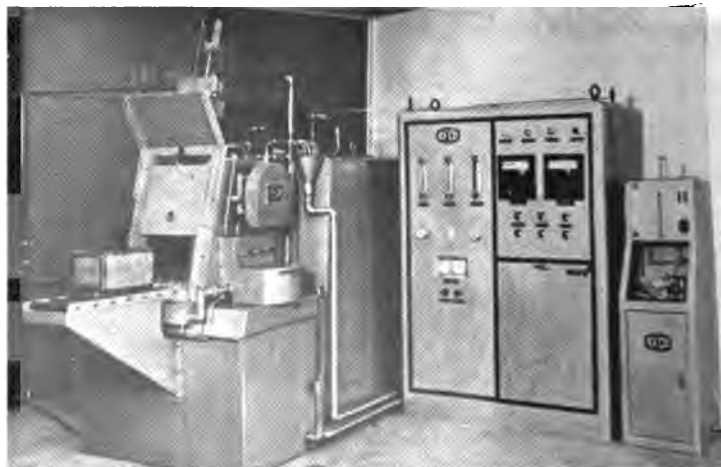
EXTENDING their range of pendant control switches, Nettle Accessories have recently introduced an emergency stop segment which can be incorporated in a crane switch assembly. The switch segment has a mushroom headed red stop button to enable quick, easy operation in an emergency. The button can be engraved either "STOP" or "EMERGENCY STOP." Price of the segment, reference CS.06, when incorporated in a pendant assembly is 2s 8d. *Nettle Accessories Ltd., Warren St, Stockport, Cheshire.*

Inspection approval

THE inspection facilities at the Oxted factory of the International Rectifier Co. have been approved by the Ministry of Aviation and the Air Registration Board. The company are now manufacturing semiconductor diodes for high voltage rectifiers. They include a stud-mounted version for 1,500 p.i.v. and 300 mA and a range of ceramic devices suitable for 100 mA at from 2 kV to 12½ kV. *International Rectifier Co. Ltd., Hurst Green, Oxted, Surrey.*

Electric quench furnace

SUPPLEMENTING their extensive range of furnaces for the machine tool industry, Efco have introduced recently their junior size furnace to provide closed-quenching facilities for economically processing small production batches. The furnace has a horizontal heating chamber, purging chamber and an oil quench tank. Work to be heat treated is placed in baskets, which may be as large as 14 in. by 8 in. and 8 in. high. These enter the furnace through an outer door complete with a gas screen to prevent air ingress. Pneumatic controls are included for the heating chamber and outer door and also for the charge elevator. Heat is provided by 15 kW radiant tube elements arranged for direct connection to a three-phase supply. They are placed in a single controlled zone which can produce furnace temperatures up to 950°C, with uniformity maintained by a circulating fan. The oil quench tank has an oil cooler and a motor-driven agitator. *Electric Resistance Furnace Co., Netherby Queens Rd, Weybridge, Surrey.*



for the electrical trade

ting the "space age" home

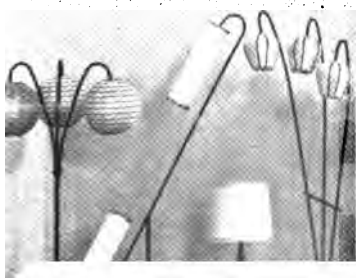
E range of "Space Age" lamp standard lighting fittings has been ing steadily and now covers a wide ion of unusual designs. The range des table lamps, single, double and floor standard models, notable for variety of shade and stand design. es are of plastics tape in some cases, ight contrasting colours wound on teel frames. Novel yet smart in rance these fittings should be as ive unlit as illuminated. Illustrated v are some of this season's models, g at prices up to £10 4s 9d tax paid. ights, 352 Cricklewood La, N.W.2.

istmas tree price

RAM announce that the price of their illuminated miniature Christ-tree is £2 5s 6d tax paid and not 8s 10d as previously stated. The mentioned on this page in 17 Nov. is 21 in. high and fitted with a lb "Lilliput" decoration set. *The ral Electric Co., Magnet Hse, Kings-W.C.2.*

fish and chip fryer

TABLE model fish and chip fryer is added to the range of EUK ing equipment. Known as "Fryette," rooker has a capacity of two gall r oil and will fry 24 lb of chips/hr. is provided by a 2.5 kW sheathed ent within the well, controlled by riable thermostat incorporating an f switch. The top is fabricated from less steel, with steam box, flue outlet a fire safety damper. Body has a of blue-grey mottled vitreous el and is mounted on four rubber Price: £51 10s. *EUK Catering inery, Oldham.*



TRADE PUBLICATIONS

IEC-SIEGER.—Technical pamphlet describing an electronic gas detector. 39 Parliament St, S.W.1.

M.K.—Leaflet No. 257, describing plaster depth boxes and square 3-gang plate-switches for use with them. M.K. Electric Ltd., Shrubbery Rd, Edmonton, N.9.

TORBAL.—Illustrated leaflet and price-list of portable precision balances. Baird and Tatlock (London), Freshwater Rd, Chadwell Heath, Essex.

PLASINTER.—19-page illustrated booklet introducing the Plasinter process of decorative/protective plastics coating. Plasinter Co. (The Plastic Finishing Co.), Wednesbury, Staffs.

MODERNEON.—45-page loose-leaf reference book on cold cathode and fluorescent illuminated signs and lettering. Moderneon, 66-68 Brewery Rd, N.7.

AQUASTAT.—26-page illustrated booklet, "The Aquastat Guide," on controls and control systems for hot water central heating equipment. Honeywell Controls Ltd., Greenford, Middx.

P.C.—Illustrated folder on Rising Main Busbar Trunking. Power Centre Co., P.O. Box 18, Lloyd St, Wednesbury, Staffs.

KANATHANODE.—32-page booklet, "D.P. Kathanode Traction Batteries," illustrated. The D.P. Battery Co., Bakewell.

I.A.E.A.—Coloured 22-page booklet listing publications issued and in preparation by International Atomic Energy Agency, Distribution and Sales Unit, Kärntner Ring, Vienna 1, Austria.

ULTRASONOSCOPE.—General catalogue of ultrasonoscopes and accessories for testing of metals. Cat. Ref. 010760/H2M. Ultrasonoscope Co. (London) Sudbourne Rd, Brixton Hill, S.W.2.

SANDERS.—Revised price-list, November, 1960, No. 161/60, of electrical accessories. For use with Catalogue No. 158/59 and leaflets 59/59 and 60/60. Sanders and Co. (Wednesbury), 78 Neal St, London W.C.2.



▲ The new slim lined "Svelte" fluorescent fitting. 125 W, 8 ft trough-type is £7 17s 6d list

The new "Whispair" floor standing air conditioner. It requires no outside air intake

◀ Some of the "Space Age" range of light fittings. Floor standards from left to right are Leo, £10 4s 9d; Virgo, £7 2s 8d; Aries, £9 6s 1d, tax paid. Table lamps are (left) Dolphus, £1 7s 11d; (back) Mars, £4 6s 10d, and (right), Colorama, £1 7s 11d, tax paid

New fluorescent fittings

A NEW range of commercial/industrial fluorescent tube fittings, "Svelte," are announced by Briticent. Designs are strictly functional but neat and slim. The fittings have bi-pin holders and range from 2 ft 20 W to 8 ft 125 W batten-type and from 4 ft 40 W to 8 ft 125 W open-end and trough-type. They are constructed from rustproof steel, finished in high gloss white stove enamel. List prices are from £2 12s 6d 2 ft batten-type to £7 17s 6d 8 ft trough-type. "Svelte" fittings may be supplied with tapped control gear at 2s 6d extra or instant-start at 14s extra list. Delivery from stock. *British Central Electrical Co., 6-8 Rosebery Ave., E.C.1.*

Air-conditioning unit

A NEW packaged air-conditioning unit for floor mounting is announced which utilises no outside intake. This unit, known as "Whispair," warms or cools air and delivers it into the room through a filter. It has automatic thermostatic control.

"Whispair" has a 2 kW heating unit and hermetically sealed compressor-type refrigeration system. Air is forced through a vertical nylon filter by two fans and passes into the room through diffusing louvres at the top of the front fascia. The filter is easily removed for cleaning. Careful attention has been paid to the elimination of noise from the unit. Sides of the cabinet are acoustically insulated and the use of two fans is said to reduce noise considerably. This conditioner has the advantage of being unobtrusive and compact. It stands 30 in. high by 33 in. wide and 10 in. deep. The entire front panel unclips to reveal all components. The unit has a maximum cooling capacity of 1,590 W. *Temperature Ltd., Fulham, S.W.6.*

Commercial radiant oven plate

GEC have launched what is claimed to be the first radiant hotplate for commercial ovens. It has two sheathed elements with a total 2½ kW rating arranged to cover the same area as a 12 in. by 8 in. solid hotplate. Control is by a three-heat rotary switch. The plate is interchangeable with a GEC solid hotplate of identical size. Price £8. *General Electric Co., Magnet Hse, Kingsway, W.C.2.*



News of the Week

APPLIANCES FROM N. IRELAND

B.S.R. Launching into New Sphere

A NEW domestic electric appliance concern is soon to be launched by Birmingham Sound Reproducers Ltd. Their well-known trade-mark for record changers "Monarch" will be utilised by a new subsidiary. Announcing this move, Dr D. McLean McDonald, chairman of BSR, said the name "Monarch Electric" is being acquired (Eveson Brothers (1928), who formed a firm of that name in 1940, have used the "Monarch" name for electric fires, washboilers, etc.) and a subsidiary of that name is being formed to make appliances. It is proposed that Monarch Electric Ltd. should establish a new organisation at BSR's existing Londonderry works, but this cannot be done other than by a complete shut-down while the new company starts its activities, Dr McDonald explained. It is hoped that the new concern will employ over 1,000 men within a few years, but at this stage no information is available on the specific appliances to be made there.

It has been known for some time that Birmingham Sound Reproducers Ltd. planned to develop other products for export, and were negotiating to manufacture compressor units for refrigerators, but the latter scheme has been held up by other difficulties. Just over a month ago

a total of 980 BSR employees in Londonderry—230 of them women—were made redundant arising from a change in export market conditions. At the present time nearly 200 workers are employed at the Londonderry factory. There has also been local speculation over the purchase by Dr McDonald of several farms in County Donegal—a few miles over the Border from Londonderry.

Pye to make reactors

PYE are to make low-powered nuclear reactors for research and training purposes. A licensing agreement with the American Machine and Foundry Group to make and sell small reactors of the US company's design has just been concluded. Pye's move is timely, for the Government is currently considering applications for financial aid from British universities desiring reactors.

B.I.C.C. shifts plastics cable manufacture

BRITISH Insulated Callender's Cables Ltd. have decided to transfer the manufacture of plastics cable and associated products from Telcon Works, Greenwich, to other factories in the group. This is the latest move in the company's programme of concentrating manufacture into specialised units. By the end of 1961, production at Greenwich will be exclusively submarine cables and marine engineering products.

H.P. ups and downs to continue

THE Government is not prepared to consider making control of hire-purchase deposits and instalment periods a permanent feature of legislation. That was made clear by Mr N. Macpherson, Parliamentary Secretary, Board of Trade, in the House of Commons last week. He was answering questions reflecting industry's arguments that there should be some semi-permanent scheme to avoid violent changes in hire-purchase restrictions. The Parliamentary Secretary said that at present, removal of hire-purchase restrictions could be treated as a means of stimulating the economy and it would be undesirable to lose that facility.

Wholesalers Acquired

COZENS and Sutcliffe (Holdings) Ltd. have expanded their activities in the electrical field by the purchase of the electrical and radio wholesaling business of RJS Services Ltd., of Stoke-on-Trent. The company will continue as before, under its own name, with Mr H. V. Cozens as chairman of the new board, Mr H. A. Knight as managing director and Mr G. S. Heymer, who was previously domestic sales manager, becoming director and general manager. Cozens and Sutcliffe (Holdings) also control A. S. Duran and Co. Ltd., electrical wholesalers, of Reading, Southampton and Walton-on-Thames.

12 or 8-hour shifts?

TROUBLES over shift work hours at Brunswick Wharf power station are now the subject of consultation between officials of the unions and the CEBG. A majority of the 167 employees at the station wanted to operate 12-hour shifts, although the management and the District JIC rejected the plan as being contrary to the national agreement which stipulates a maximum of eight-hour shifts in such stations. But a number of men, ignoring the latter ruling, started their own unofficial 12-hour rota, and this has caused incidents.

Holme Pierrepont inquiry goes on

COAL supplies and air pollution were the main subjects discussed at the resumed public inquiry into the proposed Holme Pierrepont power station, at Nottingham last week. Mr G. England, CEBG development engineer, explained that if the station used 10,000,000 tons of coal, 180,000 tons of sulphur dioxide would be discharged into the atmosphere annually, and he expected it would fall about two miles from the station. It was proposed to install a £2.28 million gas-cleaning plant having a 99.3% efficiency. Mr G. Guest, for Nottingham Corporation, suggested the latter figure was a gross exaggeration, but Mr England denied this.

Answering Mr D. Cowley, representing West Bridgford Council, Mr England agreed that, regrettably, the station would increase air pollution in the locality—it was inevitable—and he added that grit emission would be 9,800 tons a year, much of which would probably fall in Nottingham.

Earlier, when the inquiry was reopened, Mr Cowley said the refusal of the CEBG to reveal figures of coal output and coal transport costs and the refusal to give details of contracts made between the Board, the NCB and the British Transport Commission, gave rise to the greatest suspicion.

For the CEBG, Mr S. R. B. Cooke, Q.C., offered to make the figures of coal output and transport costs available to a mutually responsible and independent third party.

Mr H. W. Grimmitt, a member of the three-man inquiry panel, considered that a satisfactory way out, for there seemed to be immense complications at the arrival of the figure of £600,000 for coal costs for the station, and he was sorry the Board could not find a simpler way of presenting their case than by rather complicated computer calculations.

Subsequently, when other figures were quoted from an article by a Coal Board official, Mr Grimmitt said he was sure two such responsible bodies as the CEBG and the East Midlands Coal Board would not entertain the spending of money on a power station and then find they did not have enough coal to supply it after 1968.

At Friday's hearing, Mr H. Lawson, deputy engineer to Nottingham Corporation, suggested that the flatlands along the Trent between Newark and Gainsborough would be a more suitable site from the amenity point of view.

The inquiry was adjourned until today, Thursday, and the site was inspected this week.

SEL ECONOMIES QUESTIONED

SINCE with diesel-electric locomotives in America has not confirmed that they would make a large saving compared with steam locomotives. This was claimed by Mr H. F. Brown, an American consulting engineer, in a paper he presented to the Institution of Mechanical Engineers at its last week.

Mr Brown said that the question of steam locomotives has been regarded as a settled issue in the USA since 1950, and that nothing can be found in American cost figures to justify the often made claim that diesels are a 30% return on their investment.

Mr Brown is concerned that steam locomotives not with electric locomotives. He says expectations of savings are based on experience with a few diesel engines in the 1950-54. Long-term experience has many modifications.

For example, "evidence is now well established showing that the diesel locomotive has about half the service life of an electric locomotive in the same class."

Mr Brown said diesel engines have excellent efficiency in terms of tractive force, but single diesel units cannot develop the horsepower required for high speed trains to the same extent as modern electric locomotives. Further, and more diesel engines have to be used, it has become clear that diesels are required for a given train service than steam locomotives or the equivalent service.

Mr Brown's claim often made for the electric locomotive, that it reduces cost of track maintenance, is also contradicted by Mr Brown's conclusion is that the diesel locomotive has not revolutionised railway economics; in main it has added to the financial burden of the railways.

In his discussion on the paper there was a lack of disagreement with Mr Brown's conclusion, which he emphasised advanced to support any one particular railway motive power. In an interview given to *The Times* on the occasion of his paper, Mr Brown is saying that electric traction is the right choice for modernisation in Great Britain as London-Crewe-Liverpool.

RAILWAY FUTURE

The British Transport Commission has announced their long-heralded proposal for a revision of their modernisation programme to the Ministry of Transport, which will take the form of a year programme. Saying this in the House of Lords last week the Minister of Transport, Mr Ian Gilmartin, repeated the Government's intention to publish the report of the Inter-Departmental Committee on the subject, which has been advising the Government. It was emphasised that the committee produced recommendations, not made a report. Recommendations by the group had always been intended to be confidential to the committee and the BTC.

He said that the railway for which he had previously worked in the USA had been recommended to change as rapidly as possible from diesel traction to electrification. Mr Brown's theme seemed to be "don't modernise too fast; allow steam locomotives to wear out before replacing them." He praised British diesel-electric locomotives.

New Home Centre

LONDONERS with housekeeping problems will be able to turn to a new source of relief from 3 Jan., when AEI-Hotpoint will open a permanent Home Centre in Oxford St. The Centre will answer queries on all aspects of housecraft, as well as demonstrating the full range of Hotpoint domestic appliances. Facilities will include a lecture theatre.

Attracting electricians from Eire

ELECTRICIANS are being enticed away from Eire to work on nuclear power station sites in England at higher wages, it is alleged. The exodus has caused an acute shortage of skilled electricians in Dublin, and electrical contractors there are having difficulty in carrying out their work with depleted staffs. The main attraction to the men, it seems, is the offer of many hours of overtime, including Sundays.

E.E.—G.E.C. merger off

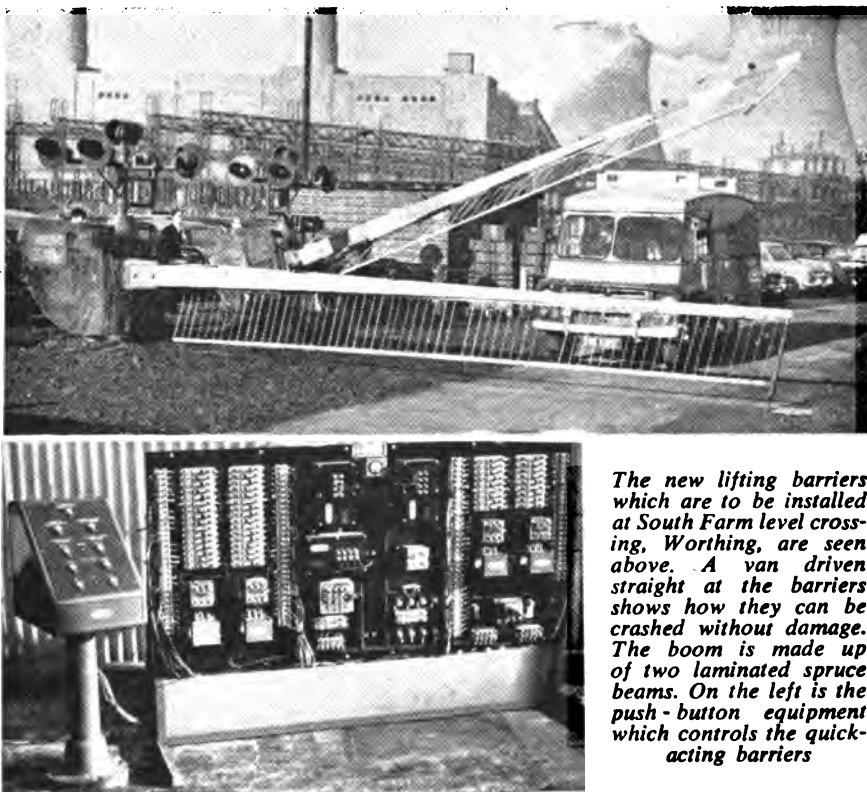
THE proposed GEC-English Electric merger is off. The brief announcement by the boards of both concerns last week simply stated that they had been unable to bring to a successful conclusion their discussions on the merger, and the negotiations had accordingly been discontinued. It was on 27 Sept. that the surprise announcement was made that there were to be discussions on the possibility of forming a holding company. Earlier there had been several rumours linking GEC with other concerns in such talks.

IMAGINATIVE CENTRE AT LINCOLN

LINCOLN'S long wait for a worthy service centre has been rewarded with quarters which would be hard to beat for facilities and design. At street level, the new centre presents a modern glass front showing display areas on three levels, with communicating stairways between the upper, lower and promenade decks. Above the ground floor, the "perpendicular" façade of the 60-year-old building has not been altered, resulting in an imaginative blend of old and new. East Midlands EB's coat of arms, in an illuminated ply-glass panel, and a blue neon sign announcing simply "Electricity" decorate the front. Facilities of the centre include a demonstration room, a conference room, and even a greenhouse on a flat roof at the rear to show methods of soil warming, propagating plants, and ventilation. Quite apart from the electrical appliances in the showroom, the uses of electricity are well illustrated by the centre's elaborate lighting and 35 kW under-floor heating in the various sales areas.



The three separate sales floors at the new Lincoln service centre of the East Midlands Electricity Board are clearly shown in the view above. The demonstration theatre and conference room, left, has infra-red lamps on the sloping section of the battens, with tungsten lighting on the flat section.



The new lifting barriers which are to be installed at South Farm level crossing, Worthing, are seen above. A van driven straight at the barriers shows how they can be crashed without damage. The boom is made up of two laminated spruce beams. On the left is the push-button equipment which controls the quick-acting barriers

Barriers to rep crossing gat

RAILWAY crossing gates as they are almost entirely on British railways. Both in America on the Continent boom-type raised and lowered either by hand or powered, have been in almost use since the earliest days. Now the crossing gate is to follow engine into history.

Work is already in hand to replace the gates at Worthing Central and Southern Region, by electrically operated barriers designed and manufactured by Rotax Ltd., and 24 to 30 planned for installation at other crossings in the next 18 months. The new spruce, balanced barriers are lowered by battery-operated motors under the control of the signaller. A push-button control column operation is accompanied by ringing of alarm bells and by flashing lights which can be seen both by day and at some distance from the crossing. Either gate can be "crashed" by a vehicle without damage to the gate and with no more than a shear pin, easily replaceable, on the control column. Warning is given to the signaller in the event of non-operation.

Nuclear Research for the Universities

PROGRESS with the National Institute for Research in Nuclear Science up to 31 March last is reviewed in the Institute's third annual report published recently. Object of the Institute is to provide facilities for universities in the form of high-cost nuclear plant. At present it has one machine working at its Rutherford High Energy Laboratory, Harwell, a 50 MeV proton linear accelerator.

Also at the Rutherford laboratory, the Institute is building a 7,000 MeV proton synchrotron "NIMROD," a major electromagnetic particle accelerating machine scheduled for completion in 1962.

Amongst the Institute's tasks is preparation of a programme recommending what nuclear reactors should be provided for universities and whether they should be built. In this respect it is to advise the Government.

This aspect of the Institute's work was the subject of a Parliamentary question last week, concerning delays on the part of the Minister of Science in deciding whether Imperial College, London University, should be permitted

to build a low-power nuclear reactor. It was pointed out that cost of the reactor might be up to £250,000. The Minister of Science's policy was to look at overall requests from all universities. (For outstanding requests, see ELECTRICAL TIMES, 1 Dec., p. 859.)

Electrical Industries Census

ELECTRICAL engineering was Britain's fourth largest manufacturing industry in 1959, according to a Board of Trade census. Sales and work done by all electrical engineering firms for the year totalled £1,462.9 million, exceeded only by the food industries, mechanical engineering and chemical manufacturing. Capital expenditure by the industry rose by about £1.4 million in the year to £56.7 million, due to increased outlay on plant and vehicles.

Unofficial Shop-stewards Ending?

SECRETARY of the unofficial shop-stewards Committee in the Electrical Supply Industry which threatened a strike in power stations earlier this year, Mr G. Wake is to resign from that position. This follows his meeting earlier this week with officials of the Amalgamated Engineering Union, of which he is a member.

REFRIGERATOR DEMAND LOW

HOME demand for refrigerators recovered slightly in October from September's poor showing, but was still 43% below October last year. Figures released by the Domestic Refrigeration Development Committee show that British manufacturers delivered 32,057 refrigerators to the home market in October, against 27,248 in the previous month. Exports continued to be bright, totalling 7,974 refrigerators for October—23% higher than a year earlier.

OFFICIAL PUBLICATIONS

Utilisation Research Report: Comparative tests on heating buildings by electric thermal storage heaters and other methods. Electricity Council (see page 898). National Institute for Research in Nuclear Science. 1959-60 (see page 898).

BS 1853. Tubular fluorescent lamps for general lighting service.

BS 3288. Insulator and conductor fittings for overhead power lines. Part I, performance and requirements. 5s.

BS 3287. Domestic electric washing machines. 6s.

N.C.B. Specification 210. medium-voltage flameproof circuit-breaker. 1s.

Line from Sizewell

DESPITE objections by some East Suffolk County Planning Committee members, the committee have approved a CEGB plan for the proposed transmission line from the proposed Sizewell nuclear power station to the previously proposed westward across the county, the new route south-westerly, skirting the fringe of Ipswich and crossing the Suffolk coast. West Suffolk County Planning Committee members maintained that the line would create a hideous sight near Ipswich. The committee chairman at Cranbrook argued that the line had to be planned on a national basis and if the proposal was accepted other counties involved, they would make as little alteration as possible.

Industry Leaders on Commonwealth Trade

SIR WILLIAM McFADZEAN, chairman and managing director, BICC, and president of the FBI, and Lord Chandos, chairman, AEI, were members of a panel which dealt with questions on Commonwealth trade at a meeting organised in London last week. Sir William gave his view that imperial preference had been diminishing in value during recent years and should be the subject of a realistic reassessment because it was proving an obstacle to European union.

He said formation of the Export Council for Europe, of which he was chairman, ought to assist Commonwealth trade, particularly as it would help to increase the demand for raw materials.

Speaking about credit for exporters, Lord Chandos said it was impossible for the UK to compete with some other countries on length of export credits without running into serious balance of payments troubles. Sir William declared that the UK had to try to avoid any credit race, though he thought the Government could go further than at present in granting credits for selected projects. An example would be a single big and profitable capital programme. He was against tax incentives for exporting companies and he thought paper work could be made simpler to help the smaller exporter, who had to be encouraged to join with larger firms in developing the export market.

Both Lord Chandos and Sir William agreed that no obstacles should be placed in the way of countries with capital surpluses investing in Commonwealth countries.

TARIFF CUTS FORECAST FOR SOUTH OF SCOTLAND

REDUCTIONS in off-peak tariffs were forecast last week by Mr W. Hutton, deputy chairman of the South of Scotland EB. He said this was despite the two reductions made since off-peak tariffs were introduced only five years ago. Continual improvement in generating efficiency made this possible. When the second section of Kincardine power station and the Hunterston nuclear station came into operation, production costs would go even lower.

Mr Hutton was speaking at the opening of an all-electric hotel and catering exhibition in Ayr. This showed a variety of appliances designed to meet the needs of those who run hotels, boarding houses and canteens.

Reinforcement in Scotland

SCHEMES costing more than £400,000 have been approved by the South of Scotland EB to improve electricity supply in the Linlithgow, Saltcoats and Alloa areas. Two substations are involved in the work, planned to be completed by 1962. At Saltcoats two 60 MVA, 132/33 kV transformers will replace a 30 MVA unit and a 33 kV line erected to Kilbirnie. A new substation will be erected at Manuel to take supplies from the Grangemouth grid.

Reorganisation in Parkinson Cowan

PARKINSON COWAN LTD. have merged two operating divisions in order to streamline marketing. Production of metering and automatic control equipment, hydraulic pumps and remote control and telemetering equipment, formerly divided between Parkinson Cowan Instruments, and Measurement Ltd., will now be controlled by Parkinson Cowan Measurement. The new division will be headed by Mr C. H. Chambers, previously divisional manager of Parkinson Cowan Instruments.

COSTING NUCLEAR POWER

PUBLICATION of a manual on costing out nuclear power projects is promised by the International Atomic Energy Agency for early in 1961. A panel of expert advisers representing nuclear energy authorities in many countries has been working on this, with the aim of helping underdeveloped countries. The Agency feels guidance on the subject to be necessary in view of its complexity, and the wide variations in assumptions and methods used in industrialised countries for estimating nuclear power costs, and so in making price quotations for nuclear power plants. It is hoped that the book will help potential customers apply to their own circumstances the cost figures available from experience of other countries.

The British members of the panel are Mr J. Gillams of the UKAEA, while Mr J. E. Shallcross of the UKAEA is acting as its consultant.

Contracting Consortium

A PROMINENT electrical contractor is one of 11 sub-contractors forming a new group under the title Consortium Contractors and Engineers Ltd. with a nominal capital of £12,000, which is being set up to undertake, in addition to their normal functions, large-scale all-trades work in commercial buildings. The consortium will be able to call upon members specialists ranging from demolition work, steel fabrication to heating and ventilation.

F. W. Blanshard Ltd., the Purley contractors, who were responsible for the London Planetarium installation, represent the electrical industry, and Mr F. W. Blanshard is joint executive director of the new organisation which has offices at 166 St. Stephens Hse, S.W.1.

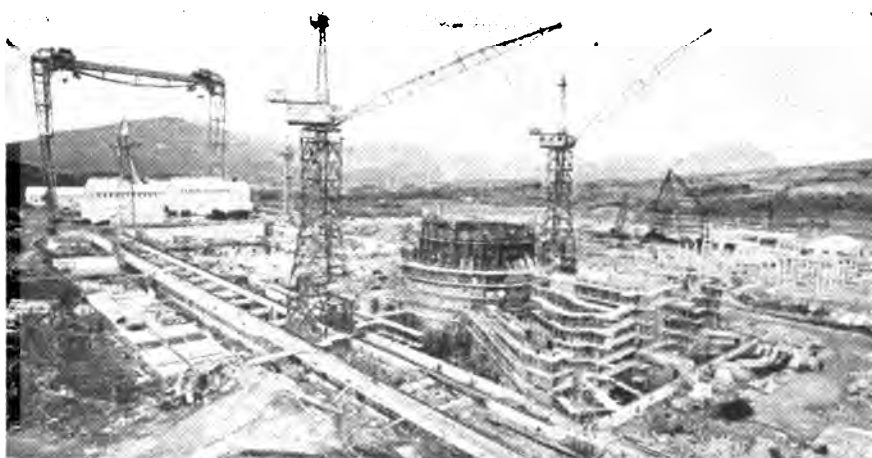
Faraday substation

THE LCC and other authorities have abandoned the idea of encasing the substation to be built on Elephant and Castle roundabout in glass because such an area of glass was considered to be too vulnerable. Other methods of showing the apparatus have failed, and the substation will now be housed in strictly functional stainless steel, with an aluminium roof. However, it is still proposed to erect a memorial sculpture on the site to Michael Faraday, who was born in the vicinity. Negotiations between the LCC and the Southwark Metropolitan Borough Council are still proceeding on the question of public access to the central island and the siting of the memorial.

Another H.P. Loss

A SERIOUS loss from bad debts has been reported by yet another hire-purchase trader—this time Easterns Ltd., the 22-store furniture and appliance chain based on London. Provision of £300,000 to cover bad debts on household equipment incurred by H.P. subsidiaries has resulted in a group loss of £230,900 for the year to August.

No. 1 reactor building is beginning to take shape at the 500 MW Trawsfynydd nuclear power station being built for the CEBG by Atomic Power Constructors Ltd. The first reactor at the station is due for commissioning in 1963



I.H.V.E. plans for international conference

PLANS for a joint international conference on heating, ventilating and air conditioning and an associated exhibition of equipment were discussed at a recent meeting of a group of contractors and manufacturers in the heating and ventilating industry, and representatives of the Institution of Heating and Ventilating Engineers and other official bodies.

The IHVE is sponsoring the exhibition, but has no financial responsibility for it. However, the Institution feels everyone would benefit if the conference, scheduled for 27 Sept., 1961, was held at the same time as the exhibition and at the same venue, Olympia.

The IHVE has devoted the sum of £1,000 towards expenses of organising the conference, and has made an appeal to manufacturers, contractors and other interested bodies to provide working capital in the form of an interest-free loan, half of which is to form a guarantee against losses. There is concern that the standard of entertainment of distinguished guests, particularly those from abroad, should be at a high level.

The meeting resulted in over half the loans and guarantees required being promised. According to the Institution, the conference and exhibition now have sufficient financial support to ensure success. However, further contributions would be welcomed from firms or individuals in the form of an interest-free loan for one year, or a donation for special hospitality. Chairman of the con-

ference co-ordinating and management committee is Mr J. R. Paterson, of G. N. Haden and Sons Ltd.

Providing cookers for tenants

FACED with the likelihood of replacing electric cookers in pre-war Council houses, East Kesteven Rural Council are seeking low quotations. They have already had an offer from the local district manager of the East Midlands Electricity Board who has offered Jackson cookers at £27 4s net, or in a quantity of £250 worth at £26 10s each, but the Council's technical sub-committee has instructed the clerk to the Council to seek a larger discount or negotiate with other suppliers.

The surveyor had earlier reported in respect of the provision of 390 electric cookers in the houses. Of these, 15 were provided by the Council, 181 were hired by the tenants from the EMEB, 37 were owned by the tenants, 69 tenants did not have an electric cooker, 40 tenants provided their own small cookers, and 47 tenants had their own gas cookers.

Farms use more electricity

FASTEST growth in the use of electricity occurred on farms in the three months to 30 Sept., when compared with the corresponding period of 1959. Latest figures from the Electricity Council, set out below, suggest an increased use of electricity for grain drying because of the wet summer and continuing rural electrification. All groups used more electricity in the latest quarter than a year earlier, and for the 12 months as a whole, but total sales for the latest three months are down compared with 23,294.9 million units sold in the previous quarter. This seasonal decline was spread over all groups except public lighting and traction. The figures, covering England and Wales only, refer to units metered or billed during the period.

Type of Consumer	3 months ended		12 months ended	
	30 Sept. 1960	% gain over last year	30 Sept. 1960	% gain over last year
Domestic ...	5,807.3	+16.0	28,773.6	+12.5
Farm ...	348.4	+18.1	1,612.7	+5.6
Commercial ...	2,111.4	+15.9	11,186.6	+11.0
Combined Domestic/Commercial ...	304.5	+12.8	1,466.6	+10.9
Industrial ...	10,628.4	+12.1	45,330.7	+13.0
Public Lighting ...	161.3	+8.8	751.4	+8.1
Traction ...	385.4	+2.7	1,565.8	+13.1
Total ...	19,746.7	+13.5	90,687.4	+12.2

Calder Hall model at exhibition

EVER wanted to try your skill with remote control devices of the type used for handling radioactive materials? You will have the opportunity at an exhibition on the peaceful uses of atomic energy being staged by Ilford Ltd. in London, from 14 Dec. to mid-February. Mainly photographic, the exhibition will include photographs from the UK Atomic Energy Authority's library, with a section on electricity from the atom. The exhibition is at Ilford Hse, 133-35 Oxford St, W.1.

Opposition to new wage plan for Engineers

DISSATISFIED because the committee set up 14 years ago by the Engineering and Allied Employers' National Federation to evolve a new wage structure for the industry, had met strong opposition, Dr J. J. Gracie, of the General Electric Ltd., has resigned from the chairmanship of that committee. It seems that the opposition to the proposed scheme came from a minority on the committee but that minority was a strong one. Dr Gracie has said that the committee had met many times to consider the difficult

and complicated problem, and a completely new approach was now under consideration. This scheme may be considered at the meeting of the Federation's management board on 21 Dec.

It is understood that the proposals supported by Dr Gracie and a majority of the committee, suggested that time and piece rates for skilled workers should be the only subjects of national negotiations; the labourer's rate would be a fixed proportion of the skilled rate; and individual firms would adjust the piece rates and grading of semi-skilled workers.

Opponents of this plan consider the present method of negotiating rates quite adequate.

More Pay for Engineers

ENGINEERS, particularly younger members of the profession, have substantially improved their relative position in the community, in terms of salaries, during the last four years. That is the conclusion of the Engineers' Guild on the basis of a survey of salaries during the financial year 1959-60, preliminary results of which are published this week.

Comparative figures are taken from the survey for 1955-56 prepared for the Royal Commission on Doctors' and Dentists' remuneration, which collected information on earnings in several professions.

Full results of the survey are promised next month; meanwhile the accompanying table shows figures for all types of professional engineers combined.

Professional Engineers' Earnings, 1955-56 and 1959-60

Age Groups	Lower Quartile £'s		Median £'s		Upper Quartile £'s	
	1959-60	1955-56	1959-60	1955-56	1959-60	1955-56
Under 35 ...	1,145	837	1,316	953	1,540	1,110
35-39 ...	1,292	965	1,501	1,142	1,789	1,376
40-44 ...	1,365	1,040	1,632	1,281	2,115	1,659
45-54 ...	1,419	1,150	1,778	1,484	2,474	2,000
55-64 ...	1,620	1,216	2,048	1,652	2,977	2,305
All ages ...	1,304	950	1,574	1,181	2,042	1,600

One-quarter of the "sample" earn less than the lower quartile figure, one-quarter more than the upper quartile

NEW CABLE SHIP

CABLE AND WIRELESS LTD. are to have their own cable-laying ship. A number of British shipyards have been invited to tender for the building of an 8,000-ton ship for delivery in 1962. The company's present fleet, and the 4,000 ton *Retriever*, nearing completion at Birkenhead, are all repair ships capable of carrying up to 400 miles of cable only. For long distance cable laying, Cable and Wireless have in the past chartered ships, mainly from the Post Office. The new cable layer will have a capacity of 1,200 miles of lightweight telephone cable with repeaters, and a steaming range of 8,000 miles. She should be available for the trans-Pacific stage of the 28,000-mile Commonwealth round-the-world telephone cable.

itch selling again

H selling was once more the of questions in the House of ns last week. Five MP's tabled ns to the President of the Board de about alleged abuses in this articularly the advertising aspect. overnment's reply indicates that ure to be discussions with the per Proprietors' Association and nodical Proprietors' Association, made recommendations to their rs about the kind of advertise- that papers should accept. The nt of the Board of Trade is not to consider legislation to control -door salesmen in the switch field until he has received the of the Molony Committee on er Protection reviewing some of hire-purchase trading.

ter Power Shortage?

ES in the daily Press about the ity of a power shortage this are likely to prove exaggerated, ation of the available statistics The fear of shortage is based on h rate of increase of sales of elec- recently, 15.8% higher in Oct. an in Oct., 1959. Relatively bad r accounts for part of the dif- , but even after allowing for this, rease is estimated at 13.4%, about the accepted "planning" increase. er, in recent weeks, electricity ed has been running at the more rate of increase of 11% above gures, before correcting for the nt weather. Electricity Council has said that recent trend in load growth were tinue, and there was particularly ather in the new year, then main- of normal voltage and fre- might prove difficult to achieve.

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OF THE WEEK
week, rain water gathered in the tummies so that they all looked it. We had a man going along et with a spike on the end of pole puncturing them." . . . MR EY PICK, designer, on the illumina- Regent St, London.
r half the boys now going into , and a much higher proportion girls, are given no planned training kind." . . . LORD MCCORQUODALE, it, British Employers' Federation, erence on industrial training.
n find nothing to say about the ity Supply Industry except that, mply, in running the CEBG our s to make it as nearly as possible : best privately owned industries her better." . . . SIR CHRISTOPHER , at the Chartered Institute of nes' annual dinner.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Tuesday, December 6					
	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	235½	+4	ZINC, virgin, min. 98% purity (cash) ...	86½	-½
" (3 months) ...	231½	+3	" (3 months) ...	86	-½
LEAD, refined pig. 99.97% purity (cash) ...	66½	-½	RUBBER, per lb No. 1, RSS, spot ...	24½d	-½d
" (3 months) ...	67½	—	c.i.f. basis, ports, Feb. ...	25d	-½d
TIN, refined, min. 99.75% purity (settlement) ...	799	—	ARMOURING: Galv. Steel Wire (0.104in.) ...	68	—
" (3 months) ...	797	—	Mild Steel Tape (0.04 x 1½ in.) ...	53*	—
ALUMINIUM, ingots 99.995% ...	186	—	NICKEL (home) ...	600	—
wire bars (4 x 4 x 54") ...	193½	—	MERCURY (76 lb flask) ...	70½	—
BRASS Strip 63/37 ...	204½	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
SILVER (Troy oz) ...	79½d	—	Lead, (New York) ...	12c	—

* Tape Price, now an average, includes varnishing

ELECTRICITY IN DEPARTMENT STORES

ADVICE on points to watch in design- ing electrical installations in departmental stores is given in the October number of FPA Journal, published by the Fire Protection Association. Five points are made:

- 1. Lamps should be clear of displayed goods, decorations and other materials.
- 2. Circuits should be arranged so that all except essential equipment can be easily switched off from the main controls when the department store is closed.
- 3. Every fault should be dealt with as it is discovered.
- 4. All wiring and equipment should be inspected and tested regularly at frequent intervals.

5. All repairs, alterations and additions, such as temporary lighting for window displays and Christmas decorations, should be carried out by qualified electricians, preferably those NICEIC approved.

Stockton Works to Close

THE locomotive works of Metropolitan-Vickers-Beyer Peacock, Stockton-on-Tees, will close in February because of lack of orders. This was announced to the 324 employees on Monday, but it was explained that the management would co-operate with any other engineering firm which may want to take over the factory. This news, given officially, follows recent rumours concerning the future of the Stockton works, which we earlier reported.

News in Brief

The EIBA has received £3,800 from the Electrical Industries' 1960 National Golf Championship—£150 more than ever before.

Lec Refrigeration Ltd. have given notice to nearly 100 employees at their Bognor Regis factory.

Some 200 customers and friends were entertained by Arrow Electric Switches to a cocktail party at the Rembrandt Hotel, S.W.7, on 30 Nov.

The North Eastern Electricity Board's redesigned service centre at Stockton was officially opened last week by Ald J. S. Darby, Mayor of Stockton.

In view of the success of its pre- decessor, the second annual Electrical Engineers' Exhibition dinner will be held on 28 Sept., 1961, again at Grosvenor Hse.

AEI-Hotpoint recently dispatched by special trains an export order for 3,000 washing machines and refrigerators.

The nation's hire-purchase debt con- tinued to tail off in October, falling £7 million to £945 million. Retail sales as a whole maintained the same level as in September but durable goods sales were still 12% lower than a year earlier.

RECENT ORDERS

AN order for 900 550 W, 24 V, portable, petrol-driven generating sets has been awarded to A. C. Morrison (Engineers) Ltd. by the GPO.

The British Transport Commission, on behalf of British Railways, Southern Region, have awarded a large railway signalling contract to the AEI-GRS Ltd. It covers the Serington-Dover section of the Kent coast lines—some 20 miles of track.

Synchronous and squirrel-cage induc- tion motors worth over £100,000, for a new oxygen tonnage plant in New South Wales, have been ordered from the Heavy Plant Division of AEI Ltd.

ORDERS EDGE HIGHER

NEW orders received by industries pro- ducing engineering and electrical goods during September were the second highest this year and about 2% higher than in September, 1959. Orders on hand edged up slightly during the month, outpacing the seasonal rise in deliveries after the holiday season. Export orders and deliveries showed a similar trend, although electrical machinery and appliances are believed not to have contributed their full share. Latest figures available from the Board of Trade for electrical en- gineering production show a slight decline from May to June, though output was still about 4% higher than a year earlier.

Company Activities

A DISTINGUISHED week! Distinguished by the fact that the snow-balling news of economic ill-omen was able last week to thump the *Financial Times* index of industrial Ordinary shares to a new 1960 "low" of 295.2—a fall of no less than 8.4 points on the previous market day. Press comment on the troubled state of the economy can be held largely to blame here in that it triggered off widespread selling. But although numerous, individual sales were not large and with some institutional support at these lower levels the market made a smartish recovery to 302.3 by mid-week. Indeed, had it not been for the element of confusion introduced by the "off-on" uncertainty over the US Ford bid for UK Ford the market would undoubtedly have finished the week higher than 300.5. For it has been the prospect of some £80 million of new money flowing into the market, especially equity sections, which has been a strong underpinning factor in stock market sentiment these past few weeks.

Meanwhile, the immediate outlook for most electrical shares, although not particularly bright, could be enhanced by the appearance of cheap buyers particularly with longer term investment in mind. Last week certainly gave a mixed bag of electrical price movements. The 7% yield now offered by AEI was enough to keep its shares at a level 41s 6d, but EMI went through to a new "low" of 40s 6d after starting out the week at 42s 9d. Plessey also dropped 2s 3d to 44s, and Dimplex after its recent run eased from 47s to 43s 9d at one time before rallying to 45s 6d. Decca Record, too, tumbled 2s 9d to 49s 9d. On the other hand, International Computers and Tabulators after slipping from 61s 9d to 58s 9d climbed back to finish

the week 1s higher at 62s 9d, and Pye, recovering from its new "low" of 12s 9d closed at 13s 7½d. E. K. Cole came in for some support and were wanted 1s 3d dearer at 19s 10½d. Compared with an equivalent price of 30s at the start of the market week, Birmingham Sound Reproducer's 5s Ordinary shares, ex the one-for-two free scrip issue, and on the news that a "Monarch Electric" subsidiary is being formed to make domestic appliances in Londonderry, advanced 1s to 31s.

But without any doubt, the biggest news for the electrical market was the announcement that the English Electric and GEC merger talks had been called off. These talks which started in September had envisaged a holding company with total assets of some £177 million. Although the mind boggled at the immensity of the merger, it none the less seemed a "natural."

Since the time it was made known that merger talks were on the £1 Ordinary shares of both have tended to run together. Both opened last week at 31s 9d and both touched new 1960 "lows" the following day—English Electric at 30s 9d and GEC at 30s 6d—before recovering to 31s 9d and 31s 3d, respectively. Then, on the "talks-off" surprise, down dropped GEC to 29s 3d but up jumped EE to 33s! The market's verdict on the breakdown, then, has been that English Electric have secured a thankful release. Any investor tossing now the coin as to which he should back here should also remember that GEC, now at 31s, are 16s 6d down from their 1960 "high" but that EE at 32s 6d could be better positioned for recovery, 20s 6d back from their peak price.—*From our City Correspondent.*

last year's payment of 20%—equal to 10% on the proposed increased capital.

Garrard Engineering and Manufacturing Co.

The offer by the Plessey Co. to acquire the Ordinary and Preferred Ordinary shares not already owned in this concern has been accepted in respect of over 90% of both classes, it is stated. The offer thus becomes unconditional.

Haffenden-Richborough Ltd.

Application has been made to the London Stock Exchange for a quotation for the 750,000 4s "A" Ordinary shares in this concern which has been newly formed to head a group of firms, one of which, W. W. Haffenden Ltd., is already well known in our industry for its rubber plugs. The other concerns involved are: Richborough Rubber Works Ltd. and Sandwich Engineering Co. The group's profits for 1959, subject to directors' emoluments and taxation, amounted to £146,959 and for the six months to June, 1960, to £98,698, it is stated. Having regard to current trading conditions it is expected that profits for 1960 will be at least £180,000. Issued capital is £150,000 in "A" and £150,000 in 4s "B" Ordinary shares, and dealings in the former are expected to start on Monday.

London Aluminium Co. Ltd.

The directors are holding up further consideration of the rights issue forecast last June until they are in a position to fully assess the impact of the transfer from Witton Wks to Wombourn and future financial requirements. The associated company, Midland Aluminium, recently acquired a 20-acre site at Wombourn, to where plant and machinery is to be moved from Witton. Major Dibben, chairman, points out that although there is an increase in the profits to date, the transfer is bound to cause some temporary dislocation of production during the last few weeks of this year and the early part of next year, which will be reflected in temporarily reduced profits. Profits for the nine months of 1960 show an improvement.

Richardsons, Westgarth and Co.

Trading since March, 1960, has been at a lower profit than in the previous year, as earlier forecast, the directors state. Shortage of work and extremely competitive conditions continue and, in the circumstances, the board has decided to make no payment of an interim dividend. It is hoped to make a reduced distribution when the results for the full year ending 1 April, 1961, are available. Last year an interim payment of 4d/10s share was followed by a final of 6d.

Dividends Declared

Bakelite Ltd. Interim 6% (5% equivalent).

Johnson Matthey and Co. Interim 3% (same).

B. S. and W. Whiteley. Interim 10% (8½% equivalent).

British Electric Resistance Co.

Working to small profit margins and relying on a continuously expanding circle of customers, bringing a correspondingly larger order book, this concern moved up the trading results once again. The Ponders End factories have been operating to full capacity with the labour force available, and to meet the growing demand a lease has been taken on a newly built factory at Potters Bar, where production has just started, Mr

H. Paul-Huhne, the chairman, reports. Although, in total, the company's export figures are up on previous years, difficulties are still being experienced in certain overseas markets, notably in India (where a new manufacturing arrangement is in process), South Africa and Canada. Excellent progress has been made in Australia and exports to Europe continue to show an upward trend.

Efco Ltd.

A one-for-one scrip issue is announced by the directors, along with an interim dividend of 7% (5%). In the first six months of the current year, orders have been substantially higher than in the corresponding period of last year, Mr Donald F. Campbell, the chairman, reports. Provided nothing unforeseen occurs, the amount paid as dividend in respect of 1960-61 will not be lower than

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1956	73,128	22,255	39	20	4/9	3/6
1957	84,779	25,335	44	20	4/10	4/1
1958	86,138	25,793	45	20*	4/10	2/11
1959	85,053	32,619	35	15	6/10	4/1
1960	100,605	39,167	35	17½	10/6	5/6

* Plus 50% capital bonus.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

given are the final for receipt of tenders unless otherwise stated.

—**Heston and Isleworth B.C.** Supply and erection of 41 Group "A" steel columns mercury colour-corrected lamps/lanterns and removal of 28 existing lamps along Vicarage Farm Rd, Houns. Advertisd 24 Nov. issue.

—**Irish Lighthouse Service.** Supply of for year.—See 1 Dec. issue.

—**Smethwick B.C.** Supply and instal- of nine passenger/perambulator lifts at housing sites. Borough Surveyor, 1 Hse. Deposit £2 2s.

—**Swansea B.C.** Supply of one 3 kW generator.—See 17 Nov. issue.

—**Bootle B.C.** Supply of (Item 13) and electrical goods and (Item 14) for year.—See 1 Dec. issue.

—**Cornwall C.C.** Applications invited for inclusion in approved list for (Item 17) electrical installations.—See 1 Dec. issue.

—**Edinburgh C.C.** Supply and erection of five electrically operated overhead at Craigmillar Refuse Disposal Wks. 1 Dec. issue.

—**Northwich U.D.C.** Installation of points in 50 pre-war houses.—See 1 Dec. issue.

—**Berkhamsted R.D.C.** Rewiring of Oliver's Close and Water End Rd. Mr. C. Laidman, 275 High St.

—**Downpatrick R.D.C.** Electrical n two blocks of four-storey maison- and one block of three-storey single- flats in Windmill St, Ballynahinch.— Nov. issue.

—**Grimsby B.C.** (c) Electrical instal- on fixed-price basis, in remodelling Parade Primary Junior School.—See v. issue.

—**Manchester C.C.** Supply and erec- of passenger lift in City Courts and e Court.—See 24 Nov. issue.

—**Roscommon C.C.** Supply and in- of 3-ph. motors, horizontal centri- pumps and water level indicator at land, Athlone.—See 1 Dec. issue.

—**Ryton U.D.C.** (5) Electric lighting at- ing work in proposed eight single- dwelling and three aged persons' ows.—See 1 Dec. issue.

—**Stockport B.C.** 2. Electrical instal- in proposed Welfare Clinic, Longford est, Reddish.—See 3 Nov. issue.

—**West Hartlepool B.C.** Electrical tion in 16 old people's flatlets, Owton estate.—See 24 Nov. issue.

—**Kirkcaldy T.C.** (b) Electrical work at- ion of new hall at Links St.—See 1 Dec. issue.

—**Swindon B.C.** Supply of (Item 12) cables, etc. for year from 1 Jan., Borough Engineer, Civic Offices.

—**Kingston upon Hull C.C.** Light- ing installations in Adelaide County y School.—See 1 Dec. issue.

—**Larne B.C.** Rewiring of 24 Arcon- icated bungalows, Edward Ave.—See 1 Dec. issue.

—**Leeds Hospital Board.** (b) Elec- work in reorganisation of main block (III) at Stanley Royd Hospital, Wake- Applications to Board Architect, Park , Harrogate, by above date. Deposit

—**Matlock U.D.C.** Supply and instal- complete of nine sewage pumps at umping station in Darley Vale.—See 1 Dec. issue.

—**Waterford C.C.** Supply and erec- of two 20 g.p.m. pumps and 380 V motors for Kill and Bonmahon water scheme.—See 17 Nov. issue.

15 Dec.—**Stockport T.C.** Electrical installa- tion in new dormitory wing and extension at "Reinbek," Aged Person's Home, Bram- hall La.—See 1 Dec. issue.

16 Dec.—**Dunbarton C.C.** Erection and wiring only of fluorescent street and foot- path lighting comprising: 35 points Seafar- 5 area and 88 points Maurhead 4 area at Cumbernauld. Applications to County Light- ing Superintendent, W. Arthur, 24 George Sq, Glasgow C.2, by above date.

16 Dec.—**Maldstone B.C.** Electrical instal- lation in conversion of 13 London Rd into an old people's hostel.—See 1 Dec. issue.

16 Dec.—**Rochester C.C.** Electrical installa- tions on fixed-price basis in 36 houses Cliffe Rd estate Section 11. Housing Mana- ger, Guildhall. Deposit £2 2s.

16 Dec.—**Sunderland B.C.** Electrical installa- tion in Maternity and Child Welfare Clinic, Hylton Castle estate.—Advertisd 24 Nov. issue.

16 Dec.—**Wandsworth B.C.** (h) Supply of lamps; and (i) electrical works for year from 1 April, 1961.—See 24 Nov. issue.

17 Dec.—**Birkenhead B.C.** Supply of lamps for year.—See 1 Dec. issue.

19 Dec.—**Nottingham T.C.** Supply of (Item 1) lamps and accessories for schools, etc., for year.—See 1 Dec. issue.

19 Dec.—**West Lothian C.C.** Supply and erection of 31 200 W sodium lanterns on 35 ft steel columns with 10 ft 6in. outreach for A8/A89 Starlaw and A8/A899 Broxburn junctions lighting.—See 24 Nov. issue.

20 Dec.—**Southampton B.C.** (a) Electrical installation renewal at Millbrook Secondary Boys' School and (b) electrical installation in new Glen Eyre Secondary Boys' School.—See 1 Dec. issue.

21 Dec.—**Fareham U.D.C.** Supply and instal- lation of sewage pump, complete with motor and control gear for Peel Common.—See 24 Nov. issue.

22 Dec.—**Ealing B.C.** Electrical installation renewal at St. Ann's Secondary Girls' School, Springfield Rd.—Advertisd 1 Dec. issue.

23 Dec.—**Eastleigh B.C.** Supply of (Item 10) street lighting lamps for year from 1 April, 1961. Borough Engineer and Surveyor, Town Hall.

30 Dec.—**Denby Dale U.D.C.** Supply, erec- tion and wiring of 225 25 ft Stanton concrete columns together with 140 W sodium lamps/ lanterns/gear along A636 Wakefield Rd and A635 Barnsley Rd. Engineer and Surveyor,

Council Offices, Denby Dale, near Hudders- field. Deposit £2.

30 Dec.—**Monaghan C.C.** (b) Erection and installation of two pumping sets to deliver 28 g.p.m. at a 106 ft head for Rockcarry scheme. Supply and/or erection of two 42 g.p.m. pumps at a 128 ft head for Newbliss.—See 1 Dec. issue.

31 Dec.—**Llanfyllin R.D.C.** Electrical instal- lation in new offices, Council Clerk, G. Jones, Council Offices, Llanfyllin, Mont- gomery.

3 Jan.—**Radcliffe B.C.** Supply and instal- lation of 43 140 W sodium lamps on 25 ft columns and brackets, plus removal of 28 existing units along A667, Ringley Rd.—See 1 Dec. issue.

5 Jan.—**Belfast C.C.** (a) Electrical installa- tion in Fane St Secondary School. City Architect's Dept., 40 Academy St, Belfast 1.

6 Jan.—**Belfast C.C.** (a) Supply of condenser tubes and (b) supply and erection of 25 germanium diode rectifier sets (Specifications W184 and 5, respectively). Electricity Dept., East Bridge St, Belfast 1.

6 Jan.—**Wanstead and Woodford B.C.** Supply of (Item 13) for year. Details from Borough Engineer and Surveyor, Municipal Offices, E.8, on receipt of large 6d s.a.e.

7 Jan.—**Bath C.C.** Supply of (Item 40) l.v. cables; (41) discharge lamps; (42) tungsten lamps and fittings; (43) steel and concrete columns; (44) street lighting lanterns; (45) control gear and capacitors; (46) time switches, for year from 1 April, 1961. City and Waterworks Engineer, Guildhall.

10 Jan.—**Dunblane B.C.** Supply and erection of seven Group "A" concrete columns/lan- terns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. issue.

16 Jan.—**Bermondsey B.C.** Supply of lamps for year from 1 April, 1961. Town Clerk, Municipal Offices, Spa Rd, S.E.16.

17 Jan.—**Newcastle upon Tyne C.C.** Supply and installation of two automatic passenger lifts in each of two 15-storey blocks of flats at Longbenton estate (Unit 4). City Architect, 18 Cloth Market, Newcastle upon Tyne 1.

28 Jan.—**Camborne-Redruth U.D.C.** Supply of (Item 24) electrical equipment and fittings for year ending 31 March, 1962. Council Clerk: S. C. Wilson.

1 Feb.—**Oxford T.C.** Supply and erection of two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Colne" limit switches—makers of? T.E.—Asquith Electrics (Colne) Ltd., Walton St, Colne, Lancs.

"Duro" vacuum cleaners—suppliers of? P.P.—Brown Bros. Ltd., Gt. Eastern St, E.C.2.

"Lucia" sewing machines—agents for? Y.E.B.—Mitchell and Korsin Ltd., 1-2 Alfred Pl, W.C.1.

"Mysto" bowl fires—makers of? E.E.R.—Bescol (Electric) Ltd., 118 Parkfield Rd, Saltley, Birmingham 8.

McGraw Electric Co., Illinois, U.S.A. agents for? C.E.—Frank V. Magrini Ltd., 24 Royal College St, N.W.1.

"Paladin" food mixers—address for? L.E.B.—P.L.N. Ltd., 9 Devonshire Rd, Chiswick, W.4.

"Moulinex" coffee mill—agents for? E.E.B.—Brattel Electric Co. Ltd., 27 Old Bond St, W.1.

"Fri-Fri" fryers—agents for? G.H.—Aga Heat Ltd., 30 Orchard St, W.1.

"Burgess" paint sprayers—makers of? W.K.—Burgess Products Co. Ltd., Brook- field Rd, Hinckley, Leics.

ANSWER WANTED

"Vistosi" lighting fittings—agents for? R.D.—

No date stated—Limerick T.C. Supply of electrical laboratory equipment.—See 1 Dec. issue.

No date stated—N.I. Hospitals Authority. Electrical engineering services installation in new home for nurses at Ards Hospital.—See 1 Dec. issue.

No date stated—North of Scotland H.E.B. Supply and erection of 132 kV steel tower double circuit spur line to Burghmuir. Chief Electrical and Mechanical Engineer, 16 Rothesay Terr, Edinburgh 3. Deposit £2 2s.—Advertised in this issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

20 Dec.—America. One 230 kV, and four 161 kV, 1,200 A circuit-breakers and one 110 kV 600 A oil or air blast circuit-breaker. Dept. of Interior, Bureau of Reclamation, Denver Federal Center, Colorado. B.o.T. (ESB/30810/60).*

20 Dec.—India. Electronic equipment, 25 items. Director, Central Stores Purchase Dept., Government of Andhra Pradesh, Hyderabad, Dn. B.o.T. (ESB/31434/60).*

20-21 Dec.—Pakistan. Hoists, four groups, of 1,000, 2,000 and 4,000 lb capacity. Chief Controller of Stores, Eastern Bengal Railway, Pahartali, Chittagong. B.o.T. (ESB/31382/5/7 and 8/60).*

21 Dec.—Pakistan. One 64 V, 200 A motor-generator. Chief Controller of Stores, Eastern Bengal Railway, Pahartali, Chittagong. B.o.T. (ESB/31381/60).*

21 Dec.—S. Africa. Two 750 kVA diesel generating sets. Secretary, Union Tender

Board, 291 Bosman St, Pretoria. B.o.T. (ESB/30792/60).*

22 Dec.—America. Supervisory control and telemetering control boards for Upper and Lower Molina power plants. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/31335/60).*

29 Dec.—America. Four 51,800 h.p. Kaplan turbines for Dardanelle Lock and Dam Power Plant, Arkansas River, Little Rock District U.S. Corps of Engineers. B.o.T. (ESB/31418/60).*

29 Dec.—Australia. Instrument cords and cordage, 15 items. Controller, Stores and Contracts, Postmaster-General's Dept., 114 Russell St, Melbourne C.I. B.o.T. (ESB/314553/60).*

31 Dec.—Yugoslavia. Dynamometers, mechanics stethoscopes, coil and condenser testers, tachometers, rev counter, penetrometers, moisture meters, heating cables, thermostats, steriliser, tensiometers, thermometers and micro switches. Laboratorija Export-Import, Zagreb, Ilica 48. B.o.T. (ESB/31358/ICA).*

4 Jan.—India. Thirty 1.5 MVA 33/11 kV transformers and nine 3 MVA 33/11 kV transformers. Superintending Engineer, Technical (Electrical), 10/13 A. C. Guards, Khairatabad Post, Hyderabad 4, Andhra Pradesh. B.o.T. (ESB/30879/60).*

9 Jan.—Pakistan. Cable terminal boxes, etc. Mr F. Rizwi, Purchase Co-ordinating Officer, Block No. 32, Post and Telegraph Directorate General, Karachi. B.o.T. (ESB/31450/60).*

11 Jan.—Sudan. Workshop distribution switch and fuse board. Sudan Government Purchasing Agent, 3/5 Cleveland Row, St. James's, S.W.1. B.o.T. (ESB/30848/60).*

12 Jan.—Pakistan. 4,800 public lighting fit-

tings comprising 12 in. c.i. cones, reflectors, etc. Directorate General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/31352/60/ICA).*

18 Jan.—Australia. 11 kV, 250 MVA switchgear: three circuit-breakers, 21 switch units, switch-fuse units. Chief Engineer, Southern Electric Authority of Queensland, 136 Boundary St, Brisbane. B.o.T. (ESB/30781/60).*

19 Jan.—India. Two 7.5 MVA 66/33 kV and two 5 MVA 33/11 kV transformers. Specification APT 28/60 from Superintending Engineer (Technical Electrical), 10-2-3 Intekhab Manzil, A. C. Guards, Hyderabad, on production of a challan for Rs 25.5 nP.

2 Feb.—India. 66, 110 and 230 kV insulators and accessories. Superintending Engineer, Technical (Electrical), 157 Mount Rd, Madras 2. B.o.T. (ESB/30880/60).*

15 Feb.—Australia. 12-channel carrier telephone system. Secretary, Victorian Railways, Melbourne C.I. B.o.T. (ESB/31454/60).*

CONTRACTS PLACED

Barton-on-Humber U.D.C. Supply and erection of 36 fluorescent street lighting units and removal of 26 existing tungsten units, Brigg Electrical Co. Ltd., £927.

Bradford C.C. Rewiring of Cartwright Hall, H. Smith (Bradford) Ltd., £937.

Enfield B.C. Supply of (1) lanterns and gear; (2) columns and brackets; (3) erection; (1) Atlas Lighting Ltd., £5,127; (2) Midland Lighting and Bldg Ltd., £8,393; and (3) H. Smyth, £3,208. Recommended.

London C.C. Supply and installation of water heaters—dwellings on Becontree estate, Essex; Downham estate, Lewisham; and Hanwell estate, Ealing, F. J. Baynes and Co. Ltd., £19,904 16s, £8,428 4s 9d and £9,295 2s 9d respectively. Supply and installation of three passenger lifts in new buildings for London School of Printing and Graphic Arts, Express Lift Co. Ltd., £52,000.

Newton Abbot R.D.C. Supply and erection of 61 Group "A" columns and lanterns at Kingskerswell, A.E.I. Lamp and Lighting Co. Ltd., £4,739.

Staines U.D.C. Provision, erection and resiting of street lighting, Midland Lighting and Bldg Ltd., £12,028.

Willenden B.C. Electrical installations in South Kilburn redevelopment area and Mortimer Rd Old People's Club, C.J.L. (Electrical) Ltd., £1,377 and £964 respectively. Recommended.

TRADE NOTES

Agents. Two new agents appointed by Elkay Electrical Manufacturing Co. Ltd. are Mr A. R. Duff, 73 Robertson St, Glasgow C.2, for Scotland, and Mr L. W. York, 179 Wood La, Earlswood, Solihull, Warwick.

Change of Name. As from 2 Jan., 1961, Wakefield-Dick Industrial Oils Ltd. will be renamed Castrol Industrial Ltd.

Change of Address. The London area order office of Atlas Lighting Ltd. is now: Angel Wks, Angel Rd, Edmonton, N.18. Telephone: Edmonton 3050.

Expansion. British Geon Ltd. are planning yet another expansion of their p.v.c. plant at Barry, South Wales. A £2 million extension is due for completion next year.

New Shop. Vallance and Davidson have opened a new electrical, radio and TV retail outlet at New Market St, Leeds.

Service Stopped. Telephone Mnf. Co. Ltd. have now ceased to provide service facilities for "Temco" clocks.

New Factory. A new factory for Sifam Electrical Instruments Ltd., in Woodland Rd, Torquay, is to be officially opened on 9 Dec. by Mr F. M. Bennett, M.P. for Torquay.

S.A. Import Tariff. Under amendments to the South African customs tariff, an intermediate duty of 15% (payable by U.K. firms) is now levied on all household refrigerators or cabinets up to 12 cu ft capacity. Previously the tariff applied to those of 5 to 12 cu ft.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Atkins Electrical Co. Ltd., 6 Russell Gdns, W.14. Nom. cap.: £100. Dirs.: Ralph F. Atkins and Mrs Margaret S. Atkins.

Baxter and Wood Ltd. Manufacturers of and dealers in light metal and plastics fancy goods, electric light fittings, etc. Nom. cap.: £1,000. Dirs.: Samuel Baxter, 157 Finchley Rd, Kingstanding, Birmingham 22a; and Jeffrey H. Wood, 128 Elmbridge Rd, Birmingham 22b.

C. and A. Electrics Ltd., 352 Normanton Rd, Derby. Nom. cap.: £1,000. Dirs.: Albert F. Cholerton and Inez M. Cholerton.

Chestercol Ltd., Midland Bank Chmbrs, High St, Colchester. Electricians, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Shirley Hart and Averill Hart.

Consortium Contractors and Engineers Ltd., 40 Chancery La, W.C.2. Nom. cap.: £12,000. Dirs.: not named. Subs.: Valerie A. Creasey and Sylvia M. Davies.

Kenneth Dolby Ltd., 45 Horsley Fields, Wolverhampton. Manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £2,000. Dirs.: Kenneth Dolby and Bernard Grady.

Engelhard Development Co. of Canada Ltd. British address: Bath Rd, Crippenham, Slough. Registered in Ontario, Canada, in

April, 1951, as Precious Metals Development (Canada) Ltd., and renamed as Engelhard Industries Development Company of Canada Ltd. on Sept. 2, 1953, and as above on Dec. 18, 1957. Capital: £500,000. Names of persons authorised to accept service: Sir Eric Speed and Gilbert L. Tugwell.

Impakco Foils Ltd., Invicta Wks, Alfred's Way, Barking By-pass, Barking. To acquire such part of the assets and undertaking of Imperial Aluminium Co. Ltd., in the United Kingdom and elsewhere, as comprises the manufacture, production, sale and distribution of foils and foil products and containers, etc. Nom. cap.: £100. Dirs.: not named. Subs.: David C. F. Pearson and M. J. Wordley.

Linyonne Ltd., 12-13 Main Parade, White-lands Ave, Chorleywood, Herts. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Kenneth Watson and Mrs N. H. Watson.

Lyon-Sanders (Electrical) Ltd. Nom. cap.: £100. Dirs.: not named. Subs.: Ronald H. Lyon, 21 Nelson Ave, St. Albans; and Mrs Olive M. Sanders, The Croft, Delmar End La, Flamstead, St. Albans.

E. J. Roe and Co. Ltd., 3 South Ave, Stoke Park, Coventry. Engineers, automation, electronic and general manufacturers and designers, etc. Nom. cap.: £500. Dirs.: Edwd. J. Roe and Mavis L. Roe.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Certor. 808,262. Class 10. Blankets. Macdonald and Son Ltd., Portland Mill, Ashton-under-Lyne.

Discus. 789,533. Class 7. Blowing machines, machine couplings, motors, generators, etc. Watkins and Watson Ltd., 17 White Lion St, N.1.

Dreamline. B806,549. Class 7. Mixing, washing and drying machines. Domestic Electric Rentals Ltd., 3 The Green, Twickenham, Middx.

Dualux. 805,898. Class 7. Steam Electric Co. Ltd., 31 Vauxhall Bridge Rd, S.W.1.

Monomatic. 764,644. Class 7. Machines and apparatus for laundering, airing, drying, washing, etc. Ada (Halifax) Ltd., West Mount Wks, Johnson St, Halifax.

Tasc. 797,178. Class 7. Variable speed transmission devices, speed governors, magnetic and induction couplings, etc. Pye Electric Ltd., 9 Upper Berkeley St, W.1.

BUSINESS PROSPECTS

Walsire. £254,320 extensions pro-
noverurie Academy.

ot B.C. Tender: Public library
including second storey. Engineer.
d U.D.C. Tender: 243 dwellings
Way area sites. Clerk.

Ja-Furness. John Laing and Son,
are contractors for Vickers-Arm-
ing-engineers) Ltd. new health and
boratory.

ead. Reynolds and Scott, 9 Albert
hester, architects for boys' R.C.
school at Park Rd West for
Shrewsbury.—Weightman and
5 Rodney St, Liverpool, architects
nibly hall, kitchen and dining
at Rock Ferry Convent Grammar
A. Stanley Barnes and Dallow, 7
Sq, Birkenhead, architects for
site of Argyle Theatre, Argyle St,
arke.

Auckland. Newcastle Hospital
enfield Rd, Newcastle, plan pre-
raining school at General Hospital.
Fennell and Baddiley, Bridge
Brs, Chester-le-Street.

vol. J. W. Anderson, 35 Clifton St,
architect for £52,000 alterations
ck Grove, Marton, factory premises
e Pools.—Premier Footwear (Fleet-
ock St, Fleetwood, plan Mowbray
ustrial development.—H. O. Luder,
y St, S.W.1, architect for 166 flats
ges, Huntingdon Rd, planned by
estments.

d. City Architect to prepare plan
opment of Richmond Rd site of
Institute of Technology to provide
its of chemical technology and
ig, etc.

B.T. Commission plans new club
off Rosegrove La.—Mecca Ltd., 76
d St, S.E.1, plan Inner Ring Rd
hall.

Brake Linings Ltd. plan Bridge
extensions.

ard B.C. Tender: 72 dwellings in
e-storey blocks, Whitwood Mere
estate. Engineer and Surveyor.—
der: Branch library, Queens Park
ngineer.

ne B.C. £5,001 improved street
cheme planned.

U.D.C. Tender: 18 old people's
s, etc., Rockingham Rd. Clerk.

B.C. Multi-storey flats and other
development planned. Engineer.

L. C. of E. authorities plan new
awstorne secondary school.

m. Sir Robert Tasker and Ptnrs,
ourt, Gray's Inn, W.C.1, architects
k of showrooms and offices at
Rd for Commercial and Industrial
s.—Candycraft, Carmichael Rd, S.
S.E.25, plan additions and altera-
factory.—E. R. Scratchley, 30 High
nton Heath, architects for Frank
Croydon), Canterbury Rd, factory.
tom. Dorman Long (Steel), Zetland
flesbrough, plan factory at Cumbie
ycliffe industrial estate.—George
and Co., Lowmill Foundry, re-
be planning removal of premises
ield Rd.

rd. Albert E. Reed Paper Group,
idilly, W.1, architects for extensions
rd Paper Mills.

Derby Diocesan Council of Edu-
an enlargement of diocesan training
y blocks of lecture rooms, hall,
s, offices, hostel. Cost: £392,000.

£280,000 Poole Grammar School
planned at Cranford Heath.

m. Sir Basil Spence, 1 Canonbury
architect for new women's college,
ll.

urne. Gee, Walker and Slater, 100
W.1, plan shops, etc., at Chatsfield,
Park and Winchester Hse site flats.

Barnet U.D.C. Tender: 24 flats,
Ed, New Barnet. Engineer and

Edmonton. H. Bernard, Eley's estate,
Angel Rd, plan factory and offices.

Enfield B.C. Tender: 40 dwellings, South-
bury Ave. Engineer.

Glasgow. John Watson and Co., 54 Black
St, Glasgow C.4, plan factory at Kyle St.—
R. F. Bluck and Associates, 147 Bath St,
C.2, architects for Sauchiehall St restaurant
for L. McLaughlin.

Grimshy T.C. £2,789 street lighting scheme
for private housing estate planned.

Hampshire. The Plessey Co., Vicarage La,
Ilford, Essex, plan industrial development
on 66-acre Titchfield site. C.C. Education
Committee, Winchester, plan £30,172
women's hostel for 20 students at County
Farm Institute. Trust Houses, Shorts Gdns,
Drury La, W.C.2, plan three-storey hotel
adjoining Winchester Cathedral.

Hastings. B.B.C., Portland Pl, W.1, plan
satellite TV station, Biscoe's Walk.

Hayes and Harlington U.D.C. Tender: 22
bungalows, 74 two-storey houses, 95 three-
storey flats, 36 four-storey maisonnettes and
garages, Frogmore Farm estate, Hayes,
Middx. Engineer.

lford B.C. Electrical installations in 33
dwellings at Mayes Brood Meadows planned.
Inclusion of seven more streets in street
lighting improvement scheme. Cost: £4,300.

Ilkeston. Winstar Products plan industrial
development on land fronting Corporation
Rd.

Kingston. Ides Ltd., Clarence St, King-
ston, contractors for Jennings and Meacock's
factory premises.

Leics C.C. Stage 2. Hinckley College
Further Education planned. Architect.

Letchworth. Shelvoke and Drury Ltd. plan
factory building; plans by Architects' Dept.
of First Garden City, Letchworth, Herts.

Liverpool. Sir Alexander Gibb and Ptnrs,
Queen Anne's Lodge, S.W.1, consulting
engineers for new mill for R. Silcock and
Sons.

London. Trehearne and Norman, Preston
and Ptnrs, 83 Kingsway, W.C.2, architects
for Sloane Ave and Draycott Ave, S.W.1,
shops and flats.—R. Wood and Ptnrs, 29
Widmore Rd, Bromley, Kent, architects for
hotel and showrooms at Kensington High
St, W.14, for Gula Investments.—Sir Herbert
Baker and Scott, Church Hse, Gt. Smith
St, S.W.1, architects for £50,000 Mecklen-
burgh St, W.C.1, students' hostel for London
University.—Stanley Peach and Ptnrs, 28
Eccleston Sq, S.W.1, architects for Sun
Engraving Co.'s new industrial building at
Kirby St and Saffron Hill, E.C.1.—Newman,
Levinson and Ptnrs, 9 Mansfield St, W.1,
architects for £150,000 administrative block,
Holloway Rd, N.19.—Land Securities Invest-
ment Trust, Devonshire Hse, Piccadilly,
W.1, plan 320 ft high office building, Vic-
toria St.—H. Fitzroy Robinson and Ptnrs,
3 Gray's Inn Sq, W.C.1, architects for re-
building of offices, flats, consulting rooms,
etc., at 26-29 Park Cres, W.1.—Newman,
Levinson and Ptnrs, 9 Mansfield St, W.1,
architects for 258 ft high hotel with cinema
and basement car park at junction Edgware
Rd, George St and Nutford Pl.—Guy
Morgan and Ptnrs, 12a Eaton Sq, S.W.1,
architects for 30-storey block at junction
of Sloane St and Brompton Rd, S.W.1.—
Campbell-Jones and Sons, 9 Dowgate Hill,
E.C.4, architects for large block of offices
at site of 117-122 Cheapside, E.C.2.

Loughborough T.C. £2,350 improved
lighting scheme planned for Derby Rd and
Bishop Rd areas. Engineer.

Maldenhead. £275,000 extensions to Cour-
taulds Ltd. Staff architect: S. A. Hawkes,
16 St. Martins-le-Grand, E.C.1.

Margate. The Thanet Press plan rebuilding
and extensions to Prices St printing works.

Middlesbrough B.C. £29,500 scheme for
installing traffic signals at Marton Rd/Lad-
gate La junction.

Newburn. J. M. Angus, 3 Gallowgate,
Newcastle, architect for club in Union Rd,
Lemington, for Labour Club and Institute.

Northern Ireland. I.C.I., Millbank, S.W.1,
plan factory on 200-acre Kilroot, Co.

Antrim, site.—B.P., Britannic Hse, Finsbury
Circus, E.C.2, plan £8 million refinery on
100-acre Sydenham site.—McCutcheon and
Wilkinson, 34 High St, Ballymena, Co.
Antrim, architects for Ministry of Com-
merce's £40,000 extensions to Ulster Chip-
board Ltd.

Nottingham. Boots Cash Chemists, Not-
tingham, plan Beeston factory.

Oxford. Mansfield College plans £80,000
three-storey block of residential accommo-
dation for students and tutor staff.—Marks
and Spencer, Michael Hse, Baker St, W.1,
plan retail store in Cornmarket and
Market St.

Penzance. S.W. Hospital Board, Bristol,
plan conversion of Edward Bolitho Home
into maternity hospital at £29,819.

Peterborough. C. W. Shelton, South St,
Stanground, Peterborough, plan 2,000 houses
at Gunthorpe.

Peterhead. Radiation Ltd., 255 North
Circular Rd, N.W.10, plan new factory.

Rayleigh U.D.C. Tender: 20 semi-detached
three-bedroom houses, Cheapside. Engineer.

Scunthorpe. Metal Box Co. plan £1 mil-
lion Scotter Rd factory.

Sheffield. The Alloy Steel and Iron Co.,
Carbrook St, Foundry, Sheffield 9, plan steel
foundry and offices, Pottery La, Whittington
Moor.—Hospital Board, Old Fulwood Rd,
Sheffield, plan seven-storey radiotherapy
building to £800,000 at Witham Rd, Broom-
hill. Architects: Adams, Holden and Pearson,
38 Gordon Sq, W.C.1.—E. G. Phillips, Son
and Ptnrs, 26 Annesley Grove, Nottingham,
consulting engineers for pathological labora-
tory at Mansfield and District General
Hospital.—Oxley and Bussey, 97 Pinstone
St, Sheffield, architects for developments at
Grenoside Hospital.—F. M. Ownsnett, Lloyds
Bank Chmbrs, Fawcett St, Sunderland, con-
sulting engineer for development of Nether
Edge Hospital.—Gleeds, 7 Clinton Terr,
Derby Rd, Nottingham, quantity surveyors
for improvements to wards at Grantham
and Kesteven Hospital.—Mackenzie, Jarvis
and Ptnrs, 34 Victory St, S.W.1, consulting
engineers for admission block, entertain-
ments hall and improvements to engineering
services at Middlewood Hospital.—Dick,
Everard, Keay and Gimson, 6 Millstone La,
Leicester, consulting engineers for accom-
modation for chronic sick at Sunnyside
Hospital, Hinckley.

Somerset C.C. Tender: Extensions to King
Alfred Secondary School, Burnham-on-Sea,
to provide 180 additional places. Plans under
supervision of R. H. Gallannaugh and
Ptnrs, Richmond St, Weston-super-Mare.
Huish Grammar School planned at South
Rd, to cost £200,000.

Stockton-on-Tees. W. Finlayson, Stockton,
plan factory.—J. W. Towers and Co., 28
Bridge Rd, Stockton, plan warehouse and
office block.—B.C. £1,083 better lighting
scheme planned for A1 trunk road between
Stockton and Eaglescliffe.

Sutton and Chess B.C. Provision of
sodium lamps for all side roads planned.

Walsall. Peck Coachbuilding Industries,
Wisemore, plan new premises at Garden St.
—S. Tomkins and Sons, 12 Dudley St, plan
Portland St factory premises.—£21,870 elec-
tric lamp scheme for residential roads
planned.

Warrington. Liverpool Hospital Board
plans £52,600 adaptation of smallpox hos-
pital at Sankey.

Watford. Cayson Electrics, 139 Queens
Rd, plan factory and offices, plot 14, Green-
hill Cres, Holywell estate.—Dawe, Carter
and Ptnrs, 32 Clarendon Rd, Watford, archi-
tects for warehouse and offices for Hertford
Handbag Co.

Wellington. Jaques, Purkis and Cole-
man, 14 Spinney Rd, Irlingborough,
Northants, plan Orchard Rd, Finedon,
factory.

Welwyn Garden City. E. D. J. Mathews
and Ptnrs, 3 Edbury St, S.W.1, architects
for Digswell Lodge extensions, for I.C.I.

Whitstable. The Riverside Press, 72a New
Rd, Gravesend, plan factory at south side
of Thanet Way.

Wigan. Street Lighting Committee plan
£2,843 for lighting on new development.

MEETINGS TO NOTE

THURSDAY, 8 DEC.

I.E.E. (Utilisation Section). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. Savoy Pl. W.C.2. 5.30 p.m.
I.E.E. (Cambridge Electronics and Measurement Group). "Recent Progress in Microwave Valves," A. H. W. Beck. Cavendish Laboratory. 8 p.m.
I.E.E. (N. Scotland). "Induction Generators for Electricity Supply," C. L. C. Allan. Electrical Engineering Dept., Queen's College, Dundee. 7 p.m.

FRIDAY, 9 DEC.

I.E.E. (N. Eastern). "The Shielding of Overhead Lines Against Lightning," J. H. Grindley. Carlisle Technical College. 7 p.m.
I.E.E. (N. Scotland). "Induction Generators for Electricity Supply," C. L. C. Allan. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.
E.P.E.A. (Meter Engineers' Technical Group). "Electronics and Metering," A. J. Baggott. Caxton Hall, Westminster, S.W.1. 6.30 p.m.

MONDAY, 12 DEC.

I.E.E. (Electronics and Communication Section). "Topology Concepts in Network Theory," P. R. Bryant. Savoy Pl. W.C.2. 5.30 p.m.
I.E.E. (Western). "Engineering Education at the Technical Universities in Western Germany," D. B. Welbourn. Professor D. B. Spalding and G. L. Ashdown. Bristol University. 6 p.m.
I.E.E. (N. Staffs). "Recent Developments in Colour Television," I. J. P. James. Duncan Hall, Stone. 7 p.m.
I.E.E. (N. Ireland). "Pumped Storage," R. W. Mountain. Joint meeting with Northern Ireland Association of the Institution of Civil Engineers. Civil Eng. Dept., David Keir Bldg, Queen's University, Belfast. 6.30 p.m.
I.E.E. (N. Eastern). Lecture: "Street Lighting," W. R. Stevens and H. M. Ferguson. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.
I.E.E. (Mersey and N. Wales). "The Potentialities of Artificial Earth Satellites for Radio-communication," W. J. Bray. Town Hall, Chester. 6.30 p.m.
BIRMINGHAM ELECTRIC CLUB. "Subscriber Trunk Dialling," H. E. Francis. Grand Hotel. 6.15 p.m.
I.E.S. (Leicester). "Stage Lighting," E. E. Faraday and W. J. Furze. Nottingham. 6.15 p.m.
A.S.E.E. (Bournemouth and District). "Electricity in Agriculture," C. W. Gould. Grand Hotel, Firvale Rd. 8 p.m.
A.S.E.E. (N.W. London). "Infra-red and its Applications," E. Gradwell. Century Hotel, Wembley. 8.15 p.m.

TUESDAY, 13 DEC.

I.E.E. (N. Eastern). Lecture: "The Transmission of News Film Over the Transatlantic Cable," C. B. B. Wood and I. J. Shelley. Workington College of Further Education. 7 p.m.
I.E.E. (N. Western). "Pharmacology of the Mind," Prof A. D. MacDonald. Annual Joint Lecture in co-operation with the Manchester University Engineers' Club, Manchester. 7 p.m.
I.E.E. (S.E. Scotland). "Energy Resources of Scotland," C. L. C. Allan and J. Henderson. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.
I.E.E. (London Graduates and Students). "Electrical Engineering in the Naval Service," D. MacLaren. Savoy Pl. W.C.2. 6.30 p.m.
I.E.E. (N. Midlands Graduates and Students). "Distribution Design in Urban Areas," W. K. Billington. Gt. Northern Hotel, Wellington St, Leeds 1. 7 p.m.
I.E.E. Faraday lecture: "Transistors and All That," L. J. Davies. Brangwyn Hall, Swansea. 6.30 p.m.
I.E.S. "Visual Problems on Motorways," J. M. Waldram. Federation of British Industries, Tothill St, S.W.1. 6 p.m.
BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "A Pulse Multiplex Stereophonic Broadcasting System," G. D. Browne. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.
A.S.E.E. (Aldershot and Districts). "Television," A. W. Binnie. Queen's Hotel, High St. 8 p.m.
A.S.E.E. (Chester and District). "Electrical Equipment in the Refrigeration Industry," A. Etherington. Westminster Hotel, City Rd. 7.45 p.m.
A.S.E.E. (Portsmouth and District). "Corrosion in Action," Committee Rooms, Ministry of Labour Offices, Lake Rd. 7.30 p.m.
A.S.E.E. (York). "The Protection of Electrical Installations," J. A. Robbins. Royal Station Hotel. 7.30 p.m.
A.S.E.E. (Oxford and Districts). "The Testing of an Electrical Installation," T. Howell. Employment Exchange. 8 p.m.

WEDNESDAY, 14 DEC.

I.E.E. (Supply Section). "A Basis for Short-Circuit Ratings for Paper-Insulated Cables up to 11 kV," L. Gosland and R. G. Parr, and "Short-Circuit Ratings for Mains Cables," G. S. Buckingham. Savoy Pl. W.C.2. 5.30 p.m.
I.E.E. (S. Western). "The Application of Irradiation in Industry," M. C. Crowley-Milling. Exeter University, Exeter. 3 p.m.
I.E.E. (N. Lancs). "Discrimination Between H.R.C. Fuses," E. Jacks. N.W.E.B. Lecture Theatre, Jubilee St, Blackburn. 7.15 p.m.
I.E.E. (Rugby). "Some Considerations in the Application of Power Rectifiers and Converters," J. P. McBreen. Rugby College of Technology and Arts, Rugby. 6.30 p.m.
I.E.E. (Sheffield). "The Determination of the Electrical Characteristics of an Arc Furnace," J. Ravenscroft. University, Mappin St, Sheffield. 6.30 p.m.
I.E.E. (S.W. Scotland). "The Protection of Electrical Systems," H. G. Bell. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 6 p.m.
INSTITUTION OF MECHANICAL ENGINEERS. "Machine Tool Research, Design and Utilization," Dr D. F. Galloway. Birdcage Walk, S.W.1. 6 p.m.
WOMEN'S ENGINEERING SOCIETY (London). "Power Transmission by Submarine Cable," Capt F. Potts. "Hope House," 45 Great Peter St, S.W.1. 7 p.m.
ROYAL SOCIETY OF ARTS. "The Functions of Trade Unions in Industry and Commerce," W. J. Carron. John Adam St, W.C.2. 6 p.m.
SOCIETY OF INSTRUMENT TECHNOLOGY (Control Section). "Speed Control of Aircraft Gas Turbines for Jet Propulsion," R. J. Walsh and R. W. Haigh. 26 Gt. Portland St, W.1. 7 p.m.
SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). Discussion: "Automation: Who Benefits?" Transport Hse, Victoria St, Bristol 1. 7.30 p.m.
SOCIETY OF INSTRUMENT TECHNOLOGY (Cheltenham). "Automatic Transmission," E. Nichol. Belle Vue Hotel. 7.30 p.m.
I.E.S. (Sheffield). "Chance and Vision," D. L. Smare. Grand Hotel. 6.30 p.m.
BRITISH INSTITUTION OF RADIO ENGINEERS (Merseyside). "V.H.F. Sound Broadcasting," L. G. Dive. The Adelphi Hotel, Liverpool. 7 p.m.
BRITISH INSTITUTION OF RADIO ENGINEERS (Southern). "Some New Piezo-electric Devices," A. E. Crawford. Lanchester Bldg, University of Southampton. 7 p.m.
PLASTICS INSTITUTE (Yorks). "Dip Coating," D. Sharp. St. Mark's Hse, 186 Woodside La, Leeds. 7.15 p.m.
A.S.E.E. (Birmingham). "Plant Engineering in

the Food Industry," L. A. Hand. Exchange and Engineering Centre, Stephenson Pl. 7.30 p.m.

A.S.E.E. (Luton). "The National Inspection Council," H. C. Breeze. Luton College of Technology, Park Sq. 8.15 p.m.

A.S.E.E. (Wolverhampton and District). "Modern Light Sources and their Application," W. A. R. Stoyke. Chamber of Commerce, District Bank Chambers, Lichfield St. 7.45 p.m.

THURSDAY, 15 DEC.

I.E.E. (Education Circle). Discussion: "How to Pass Examinations or the Psychology of Study," Savoy Pl. W.C.2. 6 p.m.
I.E.E. (Southern). Annual dinner and dance. The Polygon Hotel, Southampton.
I.E.E. (Irish). "Terminal Equipment for High Voltage D.C. Schemes," Professor C. T. G. Dillon. Physical Laboratory, Trinity College, Dublin. 6 p.m.
INSTITUTION OF MECHANICAL ENGINEERS (Nuclear Energy Group). Discussion: "The Impact of a Three-Fuel Economy," Birdcage Walk, S.W.1. 6 p.m.
CHELMSFORD ENGINEERING SOCIETY. "The Genealogy of Remote Control," A. L. Hancock. Crompton's Soc at Hall. 7.30 p.m.
S. WALES INSTITUTE OF ENGINEERS. "Experiments in S. Wales with an Instrumented Coal Plough," L. Finkelstein. W. T. A. Morgans, C. D. Pomeroy and V. M. Thomas. Institute Bldgs, Park Pl, Cardiff. 6 p.m.
DIESEL ENGINEERS AND USERS' ASSOCIATION. "Report on Diesel Engine Working Costs and Performance 1959-60," Institute of Marine Engineers, 76 Mark La, E.C.3. 2.30 p.m.
INSTITUTION OF PRODUCTION ENGINEERS (Southern). "Electronic Data Processing Allied to Production Engineering," F. W. Purchall. George Hotel, King St, Reading. 7.30 p.m.
SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). Joint meeting with North Wales Metallurgical Society. "Instrumentation in Steelmaking," N. P. Bacon. Blossoms Hotel. 7 p.m.
A.S.E.E. (S. London Branch). "Management and Utilisation," Greyhound Hotel, High St, Croydon. 8 p.m.

FRIDAY, 16 DEC.

I.E.E. (Mersey and N. Wales). "The Log-motor—A Cylindrical Brushless Variable-Speed Induction Motor," Prof F. C. Williams. F. R. Laithwaite, J. F. Eastham and L. S. Pigott. Town Hall, Chester. 6.30 p.m.
A.S.E.E. (Stoke and Crewe). "The Factors Act and the Electrical Engineer," G. L. Leighton. Grand Hotel, Hanley. 7.30 p.m.

SATURDAY, 17 DEC.

A.S.E.E. GALA LADIES' NIGHT. Connacht Rooms, Gt. Queen St, W.C.2.

GAZETTE ANNOUNCEMENTS

BANKRUPTCY ACTS

Receiving Order

Bradford. H. Rose, electrical goods wholesaler, carrying on business at 5 Carlisle Terr, Bradford 8. Receiving order dated 22 Nov.

First Meeting and Public Examination

Norwich. B. G. Firman, electrician, formerly carrying on business as Extol Electrics, at 1 Hopewell Terr, Elvington. First meeting: 11 a.m., 8 Dec., at Norfolk Hse, Exchange St, Norwich; and public examination: 10 a.m., 24 Jan., at Shirehall, Norwich.

Intended Dividends

Luton. C. R. Clarke, electrical contractor, formerly carrying on business at Kingham Way. Last day for receiving proofs for intended dividend: 10 Dec., to trustee: C. A. Taylor, 15 Guildhall Rd, Northampton.

Macclesfield. C. Davies, electrical contractor, of 39 Moss Brow, West Bollington. Last day for receiving proofs for intended dividend: 12 Dec., to trustee: G. H. Eaves, 47 Mosley St, Manchester 2.

Plymouth. L. W. Brown, radio, television and electrical engineer and dealer, carrying on business at 18 Lower Lux St, Liskeard. Last day for receiving proofs for intended dividend: 13 Dec., to trustee: A. D. Gwither, First Floor, Royal Bldg, St. Andrew's Cross, Plymouth.

Blackpool. G. Green, battery assembler,

formerly carrying on business as Flyde Batteries at 79 Back High St. Last day for receiving proofs for intended dividend: 20 Dec., to trustee: J. A. Freeman, 8 Manchester Rd, Bury, Lancs.

COMPANIES ACTS

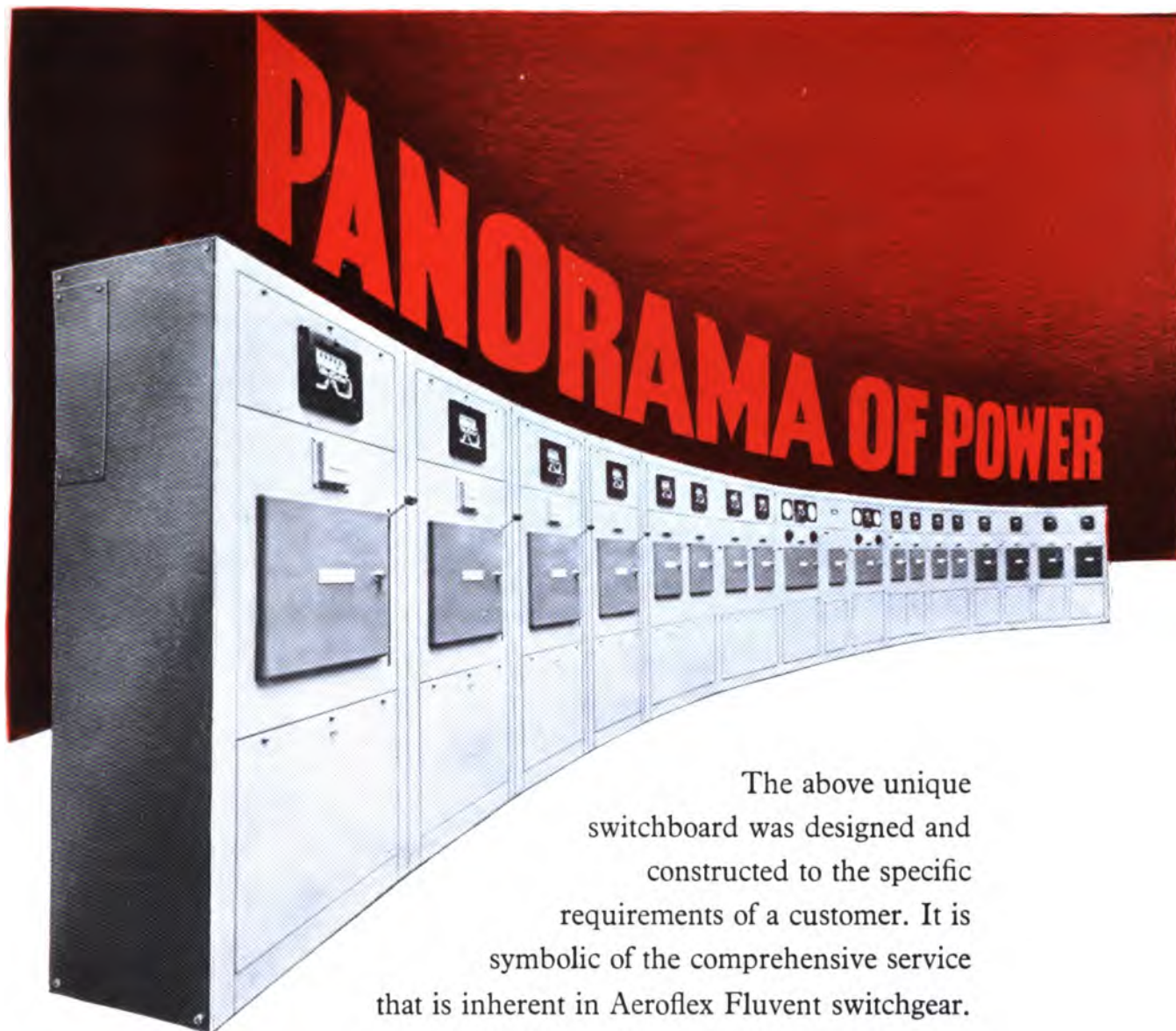
Trinity Electric Co. Ltd. Last day for receiving proofs for intended payment to preferential creditors: 10 Dec., to liquidator: F. M. Collins, Inveresk Hse, 346 Strand, W.C.2.

A.J.C. Electrics Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 12 Dec. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, E.C., by 1 p.m., 10 Dec.

S.A.L. Electrical Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 12 Dec. Persons intending to appear to notify Edwin Coe and Calder Woods, 7 New Court, Lincoln's Inn, W.C.2, by 1 p.m., 10 Dec.

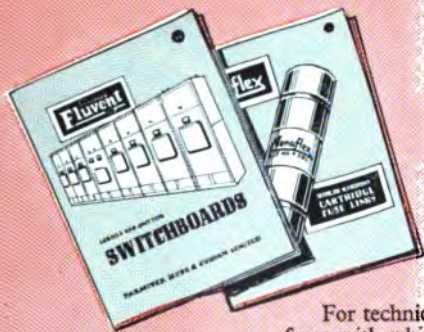
Jacques (Electrical) Ltd. and Millmans of Putney Ltd. Petitions for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 12 Dec. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, E.C.2, by 1 p.m., 10 Dec.

F. and S. Domestic Appliances (Dakota) Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 13 Dec., at 10.15 and 10.45 a.m., respectively.



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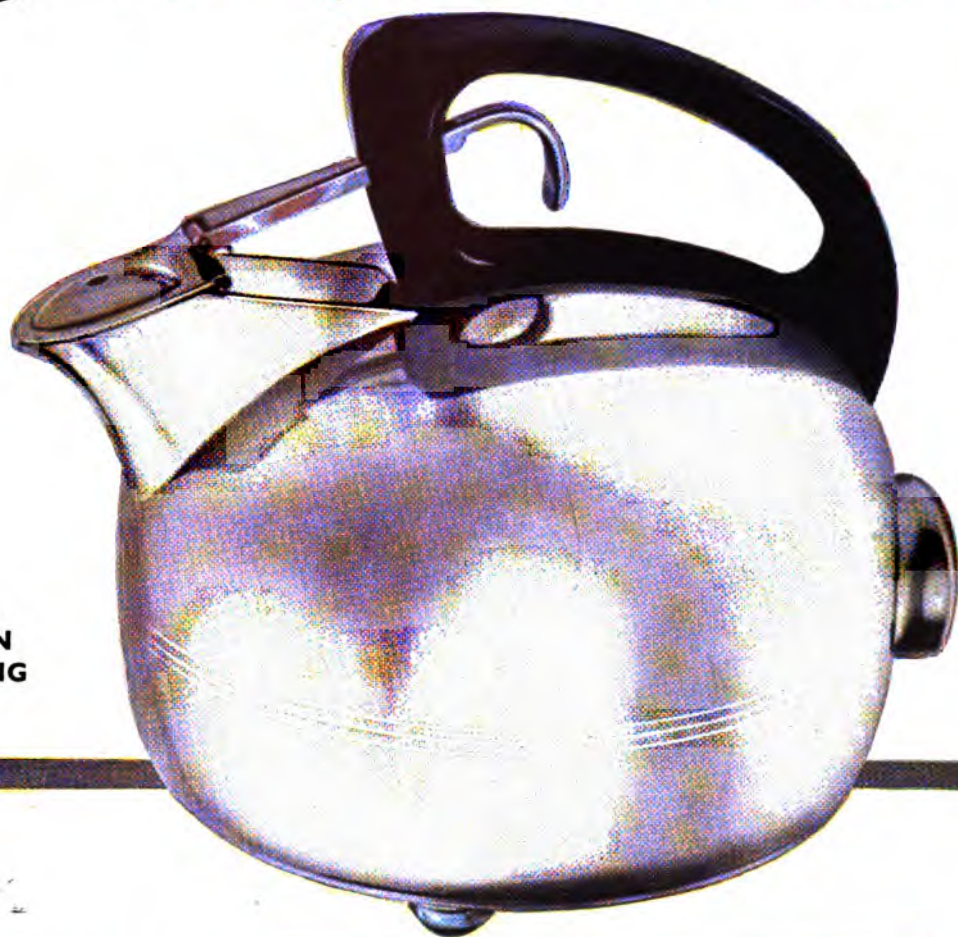
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Birmingham : 39/41 Carrs Lane, 4.

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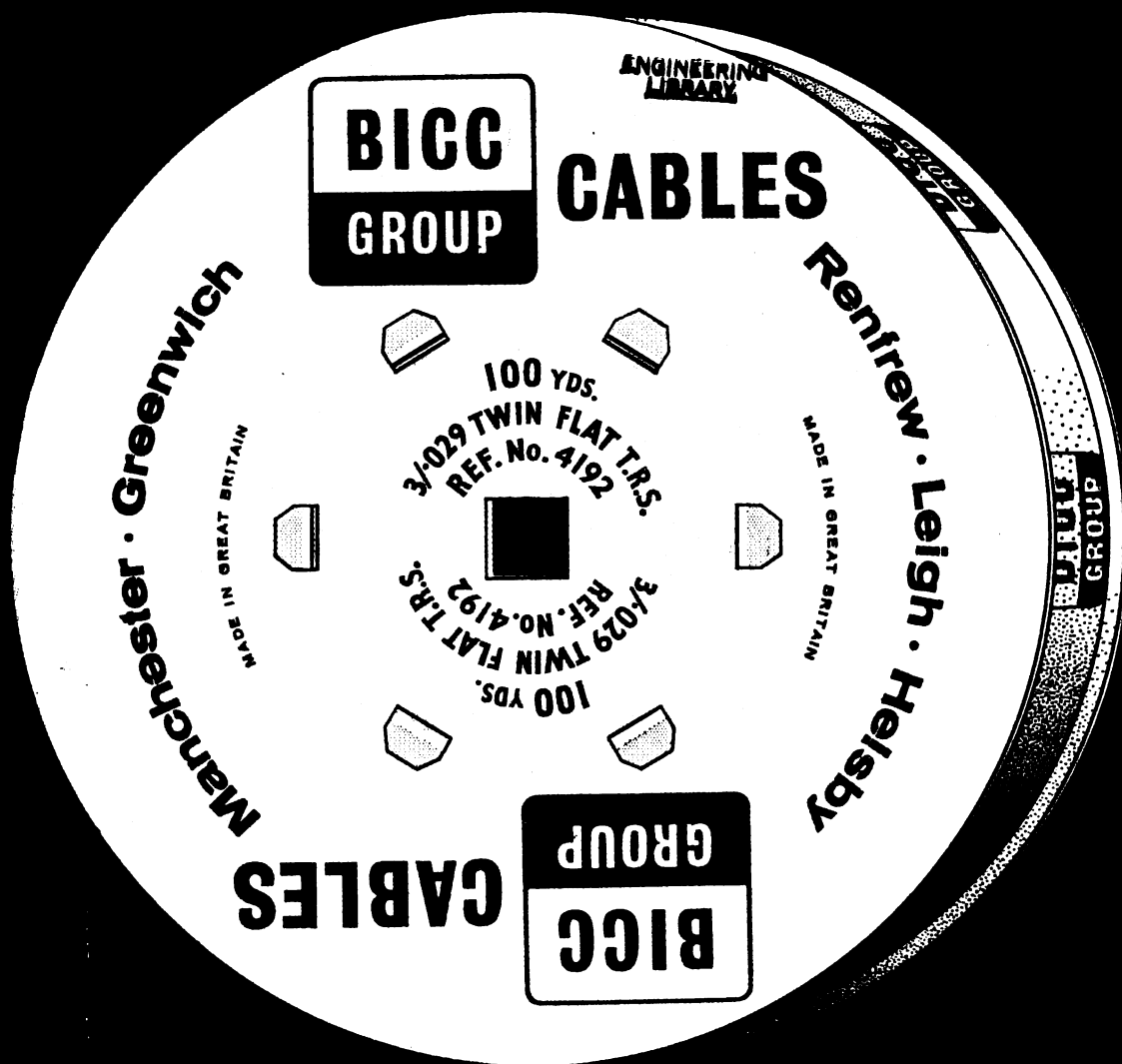
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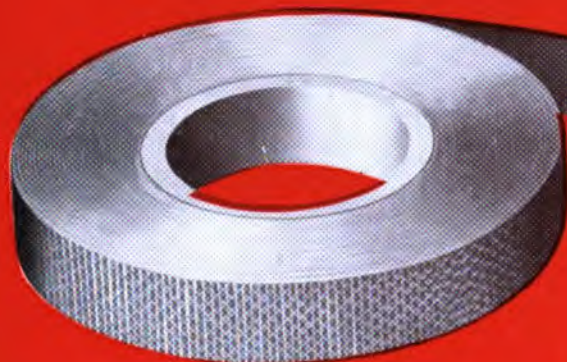
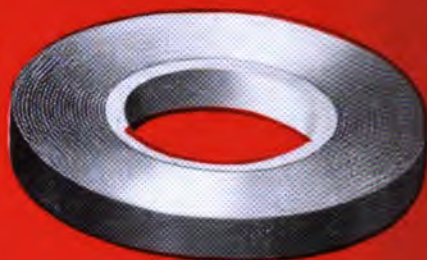
ELECTRICAL TIMES



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Comment

STANDARDS FOR APPROVAL

Publication last week of two important British Standards for domestic electrical appliances brings a reminder that standards in this category must now be looked at in the light of the imminent operation of the British Electrical Approvals Board for Domestic Appliances (BEAB). It is this body which will operate the long-heralded electrical industry's approvals mark scheme, and one of its first decisions has been to contract-out from any intention of producing test specifications itself. It will award its mark to equipment that satisfies an appropriate British Standard—or, more precisely, the safety clauses of a British Standard. This is a distinction that may prove troublesome when the scheme gets going, although those responsible are confident that no major difficulty will result. It is noticeable that of the two standards appearing last week, that on electric domestic irons, a revision, includes safety precautions and operating requirements; while the standard on domestic electric clothes-washing machines "does not deal with performance requirements but is concerned primarily with safety precautions." Until some new specification is produced—and there is rumour that a British Standard may be prepared concerned solely with safety requirements for domestic electrical appliances—the fact that the BEAB mark will presumably indicate something less than full compliance with the BS on irons, must cause confusion; especially as that standard, like others in its field, includes a reference to the BSI kite mark as an indication that all requirements are satisfied. Nor is the washing machines standard free of clauses that might not attract BEAB checking. No doubt ways around these difficulties will be found. What the electrical industry will want to be assured is that the solutions will not be such that the new scheme is lowered in the estimation of the public, who in any case are unlikely to take kindly to the realisation that the mark will imply safety only, not quality in any other sense.

DOUNREAY PROGRESS

When the Dounreay fast-breeder reactor experiment was first conceived, uncertainties about fuel supplies generally, and fissile fuel in particular, made its breeder characteristic an outstanding attraction. Today, the possibility that a commercial reactor operating on this principle may produce more fissile fuel than is fed into it is of secondary importance and unlikely to be a major factor in planning. However, the other characteristic of the system, that it uses "fast" neutrons, without slowing them down by a moderator after they are born in a fission process, has grown in significance. The fast fission process offers potentially

promising conditions for using the plutonium which will be an unavoidable by-product of the gas-cooled, graphite-moderated, natural uranium reactors soon to come into operation on the supply systems. Thus, at present, UK policy sees the fast-breeder reactor as a type required for the 1970s, probably as an ancillary to plutonium-producing reactors using natural or slightly enriched uranium, which will continue to be built even after fast reactors have proved themselves practicable. Progress in that direction was considered last week at a symposium organised by the Institution of Mechanical Engineers. As always when Dounreay is considered, the ingenuity of the mechanical engineering stood out in what was a generally satisfactory progress report. But it is clear that the coolant problem, with its reliance on liquid metals for removing heat from a core that operates at extremely high power densities, is proving extremely troublesome.

PAY BY RESULTS

How to pay a bonus to maintenance staff in factories is a problem that has engaged the attention of many works engineers. The difficulties are apparent; it is not easy to set a standard output and, in any case, lots of hard work by maintenance staff may signify a lot of breakdowns, which, from the production point of view, it is far better to be without. A partial solution is to let maintenance men share in general production bonus earnings through some linking formula, but if that is done the connection between maintenance effort and the return is undesirably tenuous. An ingenious solution is described in an article in our *Industrial Electricity* feature; to tie a bonus payment to the time for which production machines are available. Put another way round, the bonus depends on the success of the maintenance staff in preventing unscheduled breakdowns. The scheme is tied as well to more easily measured work effort on new installation and modification jobs, but it is the "machine non-availability factor" feature, as those operating the scheme name it, that makes it particularly worth the attention of works engineers. The snag would seem to lie in negotiation of the starting point, a standard for this "machine non-availability factor," but this has been overcome at one works, at least.

HIGH-COST H.V. AMENITY

The decision of the CEBG to move to four-conductor bundles for its future bulk-transmission lines, noted briefly in our pages last week, represents a major investment in meeting amenity objections to overhead lines. This effect of the change was rather overshadowed in the official announcement by the somewhat nominal, if grand-sounding, change from 380 kV to 400 kV as the stated voltage for the lines. In contrast, the change in conductor arrangement is both significant and expensive. Four-conductor bundles using the standard 0.4 sq in.

copper-equivalent s.c.a. conductors will necessitate heavier towers, which in turn are to be taller. The main outcome of the change will be that quite often a single line of double-circuit towers will suffice where two lines of towers would have been needed before. This means less lines and less wayleave trouble, so it is a substantial contribution to amenity. However, doubling the conductor area is not going to double the transmission capacity of the lines; increasingly, stability considerations set the limit to what a major transmission line will carry in the CEBG system, rather than the current rating of the conductors as determined by thermal considerations. From the stability aspect, it is voltage and (through its effect on reactance) conductor configuration that have most effect on permissible line loading. The four-conductor bundle design will help to a limited extent in this respect, but not proportionately to its greater area, as the official estimates show: 2,000 MW for a double-circuit with twin conductor bundles and 3,000 MW for four-conductor bundles. Thus, the change has limited technical advantage, a fact which should be brought home to those who are most vociferous about amenity. They have got to be persuaded that towers 20 ft higher and twice the subtended angle of conductors across the skyline have been decided on in their interests at considerable cost to the ordinary consumer.

A CASE FOR LIGHTING MOTORWAYS

Government policy at present is firm that there should be no general lighting on motorways; but experience abroad permits some doubt as to whether that decision will remain as traffic density increases on a growing mileage of British motorways. If there should be a move to lighting, it is clearly unsatisfactory to assume that the lighting design criteria should be the same as for normal, non-reserved, traffic routes. The paper which Mr J. M. Waldram presented this week to the Illuminating Engineering Society tackles this basic question from the aspect of the assistance the motorway user requires from artificial lighting; and he concludes with a list of desiderata which will try the abilities of both equipment manufacturer and public lighting engineer if full-length lighting is called for. Yet, although this specification is the declared limited object of the work which the paper reports, almost inevitably it builds up a powerful statement of the case for lighting—at least, if it is accepted that the motorways will be used to the extent which can justify the high cost of their construction. Absence of lighting implies acceptance of driving on headlights; and that is made to sound marginally satisfactory with present traffic densities, and a highly doubtful exercise if night traffic becomes moderately heavy. Nor does the problem stop there. Some natural hazards, notably patchy fog, are catered for far more safely if there is some general lighting. All this makes present policy appear highly suspect.

Meteor

Progress at Dounreay

GRESS with the UKAEA's experimental nuclear reactor at Dounreay was considered at a symposium arranged by the Institution of Mechanical Engineers last week. The papers presented describe constructional commissioning experience as well as dealing with metallurgical topics. The background to the day experiment is sketched in an introductory paper by R. V. Moore, O.C., B.SC.(ENG.), M.I.MECH.E., and Hurst, G.M., M.SC., PH.D.

Dounreay as a project dates from 1951, when the fast-neutron idea first began to receive serious engineering consideration in the UK. In fast reactors, the neutrons produced when a nucleus fissions are not slowed down (moderated) as with graphite reactors before continuing to start a new reaction by causing further fissions. The physics of the process is such that natural uranium cannot be used, on the other hand, there is less concern about the absorption of neutrons in structural materials within the reactor and there is a good chance of using plutonium as fuel. Further, the neutron economy is such that "breeding" is possible; more fissile nuclei may be generated than are used in the productive absorption of neutrons than are used in sustaining the chain reaction.

A fast reactor is essentially a highly-rated device, with a small core, and a high power/volume ratio. Leakage of neutrons from the core is an important factor and to contain them it is necessary to surround the core by a blanket of natural or depleted uranium in which U238 is transmuted into Pu239. Power rating in a fast reactor may be about 1 MW/kg fuel as against 1 MW/kg for graphite-moderated natural uranium reactors.

Dounreay project has five main purposes:

- To explore the operating and safety characteristics of this class of reactor.
- To examine the kinetic behaviour of the reactor when subjected to imposed changes in reactivity or coolant flow

- To provide a fast-neutron flux-irradiation facility for development of fast-reactor fuels and structural materials.
- To further the development of liquid-metal circuits.
- To investigate generally problems associated with the use of plutonium-based fuel.

The general arrangement of the reactor is shown in the diagram. At present, metallic fuels are used, although consideration is being given to other forms such as oxide or carbide ceramics and dispersions of such ceramics or inter-metallic compounds in matrices of stainless steel or molybdenum.

The removal of heat from the compact core is one of the major problems in a fast reactor, and liquid metals have proved particularly attractive in this respect. Sodium has many advantages, including good resistance to irradiation, high boiling point, good heat transfer characteristics, and relative inexpensiveness. However, sodium has a melting point above the usual ambient temperature, so the system must be kept hot at all times and it becomes gamma active after irradiation, so that heavy shield-



Fig. 1. A recent exterior photograph of the Dounreay fast reactor which was the subject of a symposium held last week

ing of coolant circuits is necessary. There are corrosion problems as well, and special precautions have to be taken to prevent contact between sodium and water, which react violently together. Although there has been much advance in sodium technology, the authors observe that there is still much to be learned. At Dounreay, sodium is used in an alloy with potassium (70%-30%) to lower the freezing point from 98°C for sodium to 40°C for the alloy. This worsens the heat transfer properties, increases the cost and makes the problem of reaction with water and air more difficult.

Control of the reactor is carried out by moving fuel in and out of the core.

Looking to the future nuclear power programme of the UK, the authors mention particularly that by 1970 there will be large stocks of plutonium available from graphite-moderated reactors. Since the fast-breeder reactors are efficient users of plutonium, they appear a suitable complementary type of plant to such thermal reactors. Dounreay is only an experimental project; it is thought "highly likely" that before a larger commercial fast reactor is built a prototype unit will have to be designed, built and operated. Formative stages of such a project have already begun.

Construction

The reactor contains 367 annular fuel elements composed of uranium, and 45% enriched uranium in a core measuring 21 in. diameter by 21 in. in height. The natural uranium breeder surrounds the core at the sides and top. The core is designed for a heat rating of 60 MW using sodium-potassium alloy (NaK), but it is anticipated that this rating could be increased to 85 MW if sodium only is used for the coolant. Each fuel element is housed in an annular can with an outer sheath of 0.02 in. thick niobium and an inner sheath of 0.02 in. thick vanadium. The breeder actually consists of uranium plugs inserted in the top of the fuel elements and, in addition, a radial section of 2,000 uranium elements surrounding the core.

Reactivity can be controlled by moving 12 groups, each containing ten elements. By arranging for the groups

* The design, construction and commissioning of the Dounreay reactor was described in three papers by Messrs J. Tatlock, R. R. Matthews, J. L. Phillips and others. Two additional papers, outside the scope of this article, dealt with problems of reactor metallurgy and physics.

to be actuated from below, it is possible to control the reactivity during shut-down.

By using a vanadium internal canning material for the fuel element, directional control of the fuel is ensured if, owing to an excessive temperature being attained, the fuel melts. In such an eventuality the fuel would be guided, by the outer niobium can, into the specially designed base of the core.

Heat generated in the core is removed by circulating NaK alloy downwards, around and through the fuel elements. The coolant then enters primary heat exchangers outside the core, where the heat is transferred to a secondary circuit also containing NaK alloy. The secondary circuit incorporates alloy/water heat exchangers and, since it is essential to prevent any possibility of a leak developing between the alloy and water circuits, these heat exchangers have the water and alloy circuits in quite separate tubes. Heat transfer is effected through copper laminations brazed to the stainless steel circulating tubes. Steam from the secondary heat exchanger can be used to drive a conventional 15 MW, 150 lb/sq in. gauge, 270°C turbo-alternator.

The alloy coolant is circulated by electromagnetic pumps and, since these are completely lagged, the windings must withstand a hot spot temperature of 240°C, heat being removed only by the alloy coolant. The pumps are insulated with class "H" insulation and have specially developed inorganic insulation, anticipated to have a life of at least five years.

Altogether, there are 24 primary cooling circuits, each with one electromagnetic pump. The pumps are linear three-phase induction motors which circulate the alloy coolant by induced currents. Flow is controlled by varying the voltage applied to the pump stator winding. Similar

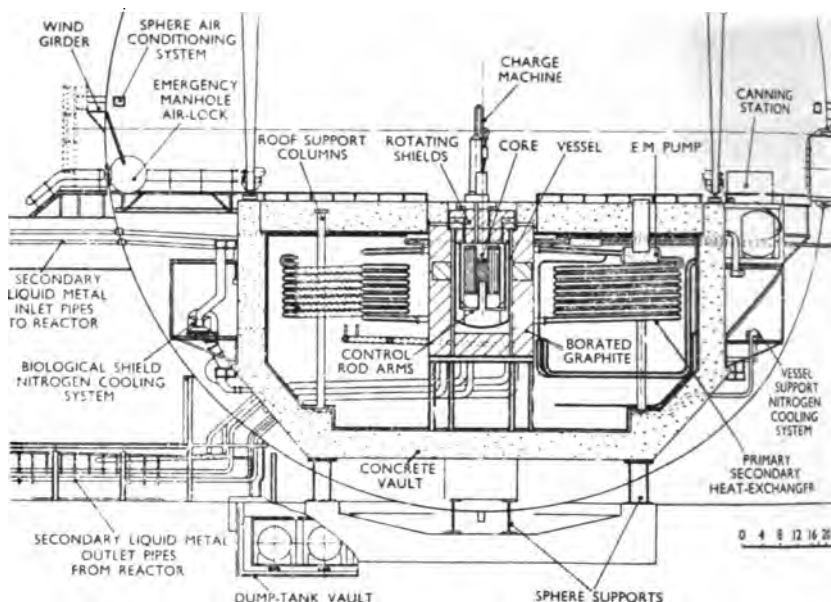


Fig. 2. General arrangement of the reactor. The heat exchanger and generator houses are omitted

pumps circulate the alloy in the secondary circuits.

To ensure efficient operation of the pumps, an inlet pressure of 12 lb/sq in. must be maintained. This pressure is ensured by a nitrogen gas blanket above the free surface of the alloy in the reactor vessel. The nitrogen gas also serves to prevent air coming into contact with the alloy coolant. It is of primary importance that the coolant circuits are maintained free of oxide, and one of the earliest difficulties with the reactor was caused by jamming of the control rod mechanism due to oxide accumulation on the moving parts.

The control rod mechanism is a U-shaped construction with one upright 14 ft long supporting a bottom arm. The upright contains a rotatable threaded shaft which causes the other upright to move vertically. This second upright supports the group of controlling fuel elements. Movement of the fuel group is caused by rotating the threaded shaft and it was due to formation of oxide film on this shaft that jamming occurred. The control rod mechanism is sealed to prevent nitrogen gas leakage. To obviate glands, an electromagnetic drive is used. This comprises a rotating electromagnet which transmits torque to an armature attached to the vertical rotating shaft, through a stainless steel diaphragm, which also provides the gas seal. Under emergency conditions, the control rod assembly can be dropped by de-energising a supporting electromagnet.

Returning to the problem of oxide removal, the first solution adopted at the design stage was to incorporate cold traps through which a quantity of the coolant could be circulated. During the subsequent construction it was decided that the limit of oxide reduction to ten part p.p.m. obtainable with cold traps was not good enough and hot traps were added. These incorporate a zirconium getter capable of lowering the oxide content to 5 p.p.m. The coolant is circulated through the getter at 600°C, the temperature being main-

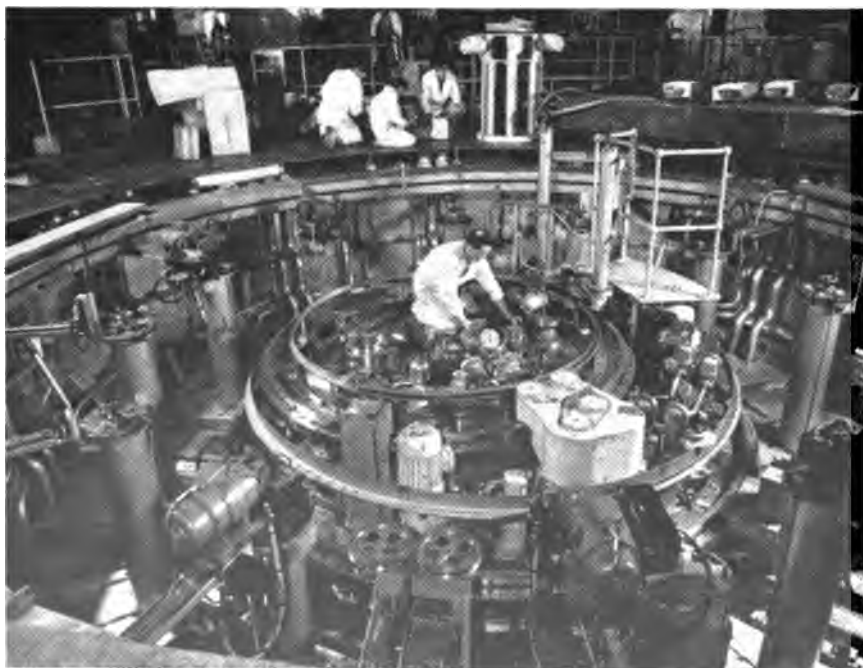


Fig. 3. Inside the pressure dome. The top of the stainless steel pressure vessel is visible in the reactor vault surrounded by the control rod and ion chamber operating gear

by 35 kW electric heating elements each 6½ ft long.

Commissioning

Initially, construction was scheduled for completion early, 1958, but the incorporation of hot traps and modifications delayed completion to the end of 1958. Therefore, testing was possible during part of this period. Testing was completed in June, 1959, when the gas was charged into the circuits. The reactor went

critical in November and operated at zero energy for determining control parameters until the following April. It was then shut down for modifications to the core and to find ways of preventing gas entrainment in the coolant circuit. This difficulty occurs when the coolant flow reaches 70% of the rated value and has so far prevented full investigation of the cooling circuit characteristics. It is expected that the problem will be overcome early in the new year.

DISCUSSION

W. B. HALL said the fast reactor had been studied for ten years and in the meantime there has been a shift of emphasis from its possible use as a plutonium breeder to a form with high power density suitable for power produc-

Rating	Fast reactor	Thermal reactor
U235 kW/kg	286	500
total U kW/kg	80	10
reactor kW/cu ft	14,000	100

able, above, suggests there is a factor of 140 for heat release/unit volume in the fast reactor compared with the thermal reactor. Can an economic limit be set on the basis of rating? One design problem is providing for higher rates of heat release. Did the authors consider there are applications for liquid fuel? For example, sodium, which are allowed to melt the core thus imposing a less strain on cladding materials. The heat flux at the surface of fuel elements is 0.6 kW/sq cm and he thought the heat transfer problem had not been fully emphasised in the paper; in a thermal reactor, heat transfer corresponds to a gradient of 3,000°C/cm. In stainless steel and 500°C across 1 in. of nitrogen gas. They are, therefore, well outside normal engineering practice.

Thermal stresses in liquid metal-cooled reactors he thought are exaggerated. He would like to know the authors' views? Professor Hall, commenting on the value of an electromagnetic pump, said the value was that they should be larger; they then be more economical? He asked if stainless steel was better for cladding than the vanadium and zirconium cladding materials used for the reactors. For example, it might be the omission of hot traps possible, he asked the authors if, in their view, the stringent inspection requirements mentioned in the paper could be applied to future reactors.

JOHN S. W. JOSLIN (ch. insp. MoP) commenting on the excellence of the paper, offered the slight criticism that it gave little indication of lessons learned or experience gained on the thermal reactor. For example, the original design for using a 24 circuit cooling arrangement was

that only 4 in. rigs were available. The safety requirements were considered to be secondary. However, there were also 18 generator sets and it therefore seemed that safety considerations carried rather more weight than the paper implied. Referring to impurities in the cooling circuit he asked if the figure of five parts/million quoted had actually been achieved for oxide content and whether improved cleaning of the sodium potassium alloy from the control rods had been obtained after redesign.

PROF. J. M. KAY said the Dounreay type of fast reactor (DFR) was inherently an unreasonable source of industrial power in its present form, because of the very small core size and the high heat rating which was necessary to obtain useful amounts of power. Referring to the size and rating of the core, for a larger power rating it would be necessary to dilute the core, but this would give an intermediate rather than a fast reactor. Was it possible to obtain a clear picture of the form which a prototype power-producing reactor might take? For example, would it have a larger core? Referring to burn-up he said there was no future in the fast reactor with metal fuels and asked what the prospects were for non-metallic fuels.

In reply, Mr Moore, referring to Professor Hall's questions, said there were great difficulties in optimising all forms of reactor and optimisation of the fast reactor was not yet understood, although in the last year a digital computer had made it possible to survey the parameters involved in a shorter period of time. A compromise was necessary between what the fuel elements could do and what was economical. The next step in the programme for DFR was to design an economical plant. Thermal efficiency was high, therefore the capital cost would probably be low, but it could vary with rating. Replying to General Joslin, he said many of the original design features would now be changed in the light of experience, certainly a modern design would not use 24 external cooling circuits. In the early days the melting problem was not fully understood and there was little knowledge of the behaviour of sodium. The construction used would certainly not be economical today and this was also true of the heat exchangers.

MR TATLOCK, also in reply, said he

was in agreement with Professor Hall's table. Liquid fuels, he thought, would not be popular with the metallurgist and one difficulty would be the removal of fission products. Thermal stresses were exceedingly low except in fuel elements and it should be remembered that baffles were fitted to reduce thermal shocks.

MR MATTHEWS, in reply, said the electromagnetic pumps had proved to be very satisfactory. Consideration was being given to a prototype design for a 6,000 gall/min pump. One difficulty with the pumps was that they required thin stainless steel ducts and were, therefore, not very robust in large sizes. There was also the problem of heat removal from the windings. The pumps also had a low efficiency, only 40%, compared with the 75% to 80% for mechanical pumps. But at present they had no choice but to use the electromagnetic pump. There was quite definitely no relaxing of inspection requirements indicated by experience on the DFR. Value of the stringent requirements had been proved by the fact that no leak had been detected in the 18 months during which coolant had been in the reactor and it was certain that cost of leak repairs, especially in the primary circuit, would far outweigh inspection costs.

PROF. C. R. TOTTLE, commenting on the suggested use of liquid fuel, said it must be remembered that the compatibility problem would be very much worse. It was true that sodium filled fuel was not desirable but there was at present no better solution available.

MR PHILLIPS said it was hoped that the gas entrainment problem would be solved early in the new year, there would then be a progressive increase in power output to June, then a rise to 15 MW to 20 MW by the end of 1961.

Dr Hurst, summing up the symposium, said that it seemed the trend of the discussion was to compare fast with thermal reactors. However, the fast reactor should always be regarded as complementary to the thermal reactor and not as its rival. The next step would be a prototype DFR then a civil reactor probably in the 1970's. Although the DFR might, at first sight, seem complex, there was greater freedom in geometry and fuel enrichment and the design was simpler and cleaner than for a thermal reactor. The materials problem was certainly among the most important and the most intractable.

Marine self-regulating alternators

by J. Griffin,* A.M.I.E.E.

PART 2

IT is the principal purpose of the present article to examine four self-regulating marine alternators currently available. In Part I, after a general consideration of the problem of self-regulation from its technical aspects, the L.S.E. "Altoreg" alternator system was described. Two further British systems and one Continental are described in this concluding part.

The Allen Self-regulating Alternator

In the Allen self-regulating alternator system, the alternator itself is of orthodox construction, but the conventional rotating exciter is replaced by a completely static excitation circuit in which shunt and series elements are so combined as to produce inherently a total excitation approximating, at all loads and power factors, to that required for constant alternator terminal voltage. The basic system is supplemented by an automatic "trimming" control to improve the inherent steady-state regulation to within the required closer limits.

The complete excitation and control schematic is shown in Fig. 5, from which it may be seen that a shunt transformer provides a nearly constant "no-load" or magnetising excitation component; an additional "on-load" component (inherently approximately correct in both magnitude and phase) is provided by a separate series transformer, the rectified output from the series-connected transformer secondaries being fed to the alternator field winding. Since the combination of the shunt and series components takes place on the a.c. side of the rectifier, the system is sensitive not only to the magnitude but also to the phase of the load current. The principle is thus that of phase-compensated load-current compounding, and the basic system alone is inherently capable of a steady-state regulation of about $\pm 5\%$ at all loads and power factors. A ballast reactor in the shunt circuit provides some measure of compensation for the resistance/temperature variations of the alternator field winding. The use of separate shunt and series transformers facilitates test-bed adjustment to suit the alternator or prime-mover characteristics, adjustable air-gaps being provided on the ballast reactor and the series transformer.

The inherent or "functional" control exercised by the basic circuit cannot in practice provide the extreme accuracy of voltage control normally required, and some sort of supplementary automatic trimming control is essential. The one provided is a simple automatic regulator of the static magnetic amplifier type, with a Zener diode bridge as the voltage reference. The regulator output current controls the impedance of a saturable control reactor connected in parallel with the ballast reactor, and the total impedance of the shunt circuit is thus varied slightly in response to any small voltage discrepancies detected by the regulator. For parallel operation a conventional quadrature-droop compensation signal (obtained in the usual way from a current-transformer-fed resistor)

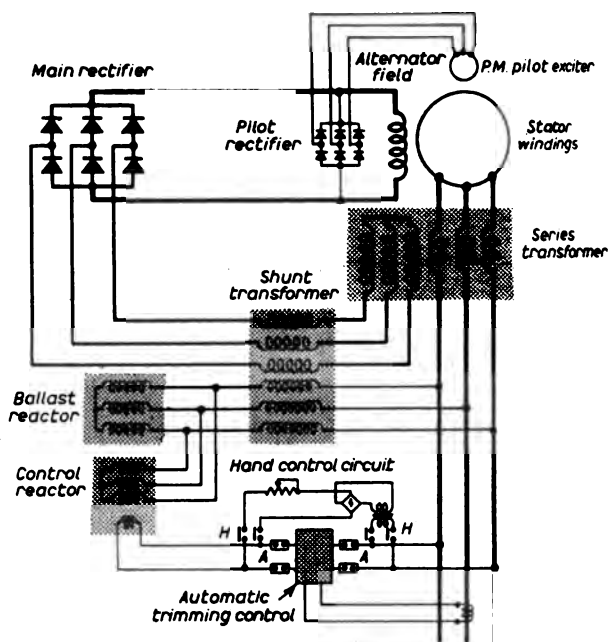


Fig. 5. Allen Self-regulating alternator system using a conventional alternator with static excitation equipment

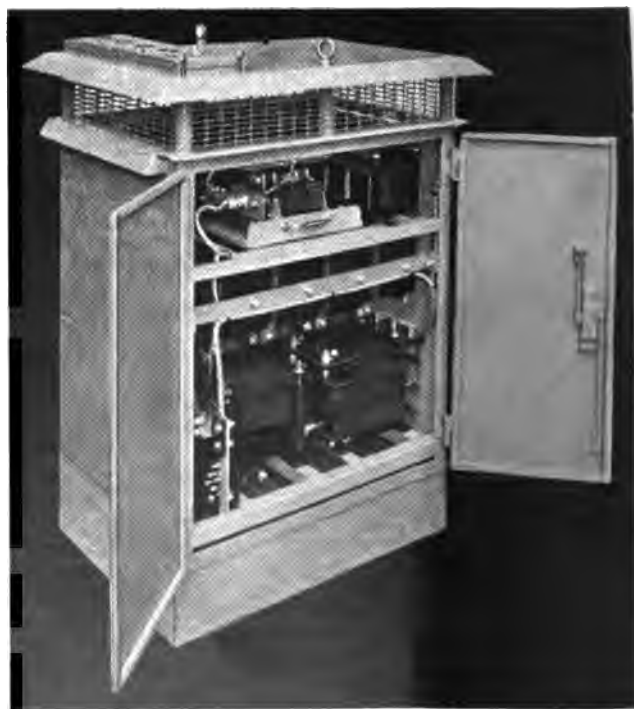


Fig. 6. Static excitation and control cubicle for 230 kW, 600 r.p.m. Allen diesel alternator

* Mr Griffin is with W. H. Allen, Sons & Co. Ltd. Part 1 of this article appeared on 8 December, page 877.

roduced into the voltage circuit of the automatic
ing control. An alternative hand-control circuit,
ising the automatic trimming control and comprising
ll transformer and rectifier and a hand regulator, is
led for use in the event of trimming control failure.
ial excitation is obtained from a small permanent-
st pilot exciter through a pilot rectifier connected
nently in parallel with the main rectifier. The pilot
1 is designed to produce sufficient alternator terminal
e to enable the main excitation circuit to become
staining; in this instance the initiation is independent
: alternator residual voltage, no starting switch or
is required, and during normal operation the exciter
ked out of circuit by the pilot rectifier.

: manufacturers of this particular system prefer to
/ the major excitation and control components in a
ite self-ventilated cubicle. The alternator itself is of
lox construction except for the absence of the usual
exciter, and the "initiative" pilot exciter is normally
e bearingless overhung-rotor type with its stator
d on a bracket on the bearing pedestal.

s claimed for this system that in general the voltage
d recovery time for a given impact load are both
about half those of a conventional alternator with
lectro-mechanical a.v.r.; a transient voltage dip
t no-load of only 12% with a low-power-factor
t load of 100% is said to be typical of four-pole
-alternators of about 400 kVA upwards, and the
ponding recovery time is about one-half of a second.

The G.E.C. "Accurex"

: GEC "Accurex" system is generally similar to that
: Allen alternator, and its principle of operation is
the static phase-compensated load-current compound-
f an orthodox alternator with no rotating exciter. It
s from the Allen machine only in its use of a single
bining" transformer, in the method of excitation
ion, and in various more or less minor details.

: basic circuit schematic is shown in Fig. 7, from
it may be seen that the single alternator field wind-
excited from a main rectifier which is in turn fed
the secondary winding of a "combining" transformer
g two separate primary windings. One of these, the

"shunt" primary, is fed from the alternator terminals
through a saturable control reactor; the other, or "series"
primary, carries the alternator output current. Once again,
the shunt circuit provides an approximately constant "no-
load" or "magnetising" excitation component, while the
series circuit provides inherently an "on-load" component
of the correct magnitude and phase to compensate
approximately for the alternator armature reaction. The
necessary combination of these two components is achieved
by means of the transformer, whose secondary output is
the vector combination of the two primary components.

As with the Allen system, the steady-state voltage
regulation provided inherently by the basic circuit is

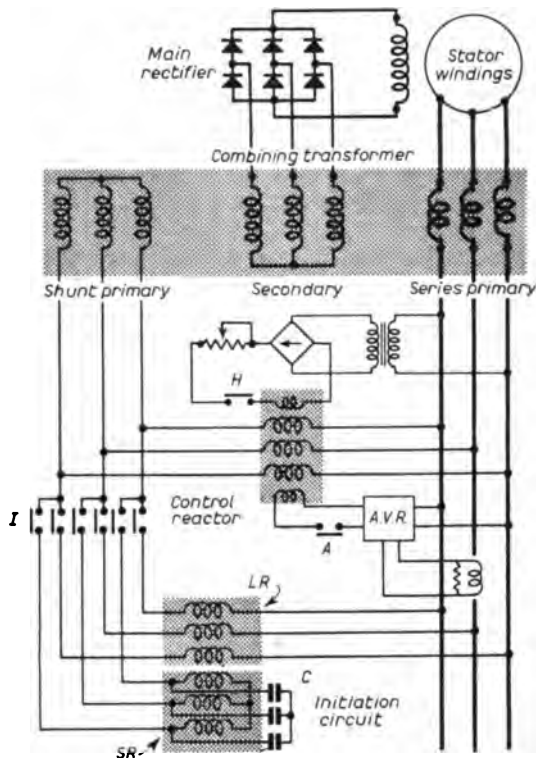
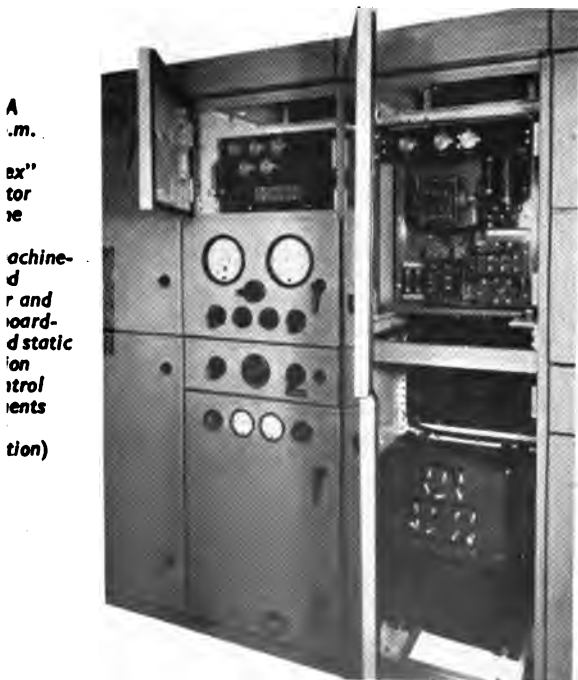


Fig. 7. GEC "Accurex" system



considered insufficiently accurate, and an automatic trimming control, again a static regulator of the magnetic amplifier type, is provided. The regulator output controls the impedance of the saturable control reactor (and hence the magnitude of the shunt excitation component) in response to any minor voltage variations. For parallel operation, conventional quadrature-droop compensation is provided, and a hand-control circuit (comprising a small constant-voltage transformer, a rectifier and a hand regulator, and feeding an alternative control winding on the saturable reactor) caters for the possibility of an automatic regulator failure.⁸

The method of excitation initiation now employed resembles that of the Siemens machine to be described later, but in addition to being only temporarily connected (by means of a hand-operated initiating switch or push-button) it also contains a voltage-limiting element. In the "initiative" connection a linear reactor LR, shunted by a capacitor C, provides an alternative feed to the "shunt" primary of the combining transformer. The reactor and the capacitor are arranged to resonate at the normal supply frequency, and the considerably increased voltage thus obtained from the relatively small alternator residual voltage is sufficient to initiate true self-excitation through the normal circuit. A saturating reactor SR is connected across the capacitor to limit the alternator voltage produced by the initiation circuit alone to about half the normal value.

The alternator to which this system is applied is of orthodox construction. In this instance, however, most of the excitation components are normally accommodated on the switchboard; a major exception is the main rectifier, which is mounted on the alternator itself and cooled by the alternator ventilating air.

The transient voltage response characteristics obtainable with this system are generally similar to those of the Allen alternator. A typical low-speed performance claimed is a transient voltage dip of only 18% with a low-power factor impact load of 100% on a 14-pole alternator, and the corresponding recovery time is about one-half of a second.

The Siemens "Constant-voltage" Alternator

The Siemens machine, typical of several generally similar Continental alternators, is probably the simplest of its kind currently available, and its principle of operation is again that of the wholly static phase-compensated load-current compounding of an exciterless but otherwise orthodox alternator. The circuit schematic is shown in Fig. 9, and it will be seen that the principal excitation components closely resemble those employed in the "Accurex" system; there is, however, no automatic trimming regulator.

The alternator field winding is excited from a rectifier, which is in

turn fed from the secondary winding of a combining transformer with two primary windings. One of these the "shunt" primary, is fed from the alternator terminals via a "magnetising" reactor; the second, or "series" primary, carries the alternator output current, and the now familiar pattern of a constant "no-load" component supplemented by a variable "on-load" compensation component is thus repeated.

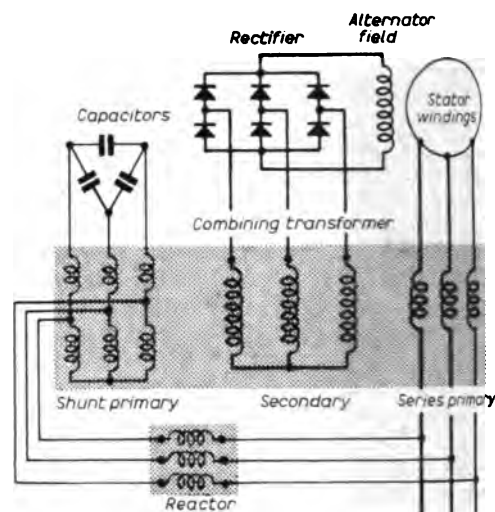


Fig. 9. Siemens "Constant-voltage" alternator system

The major part of the shunt primary is itself shunted by a capacitor connected via a second section of the winding. This capacitor, which at normal frequency is approximately resonant with the magnetising reactor, provides inherent compensation for the resistance/temperature characteristic of the field winding,⁹ and it also plays a part in the excitation initiation.

As has already been mentioned, the principal difference between this system and that of the "Accurex" is that in this instance no form of automatic regulator is employed: the system is thus wholly "functional." In practice, not even hand regulation is provided, and any necessary adjustment is by means of reactor and transformer tappings and by means of a variable air-gap on the

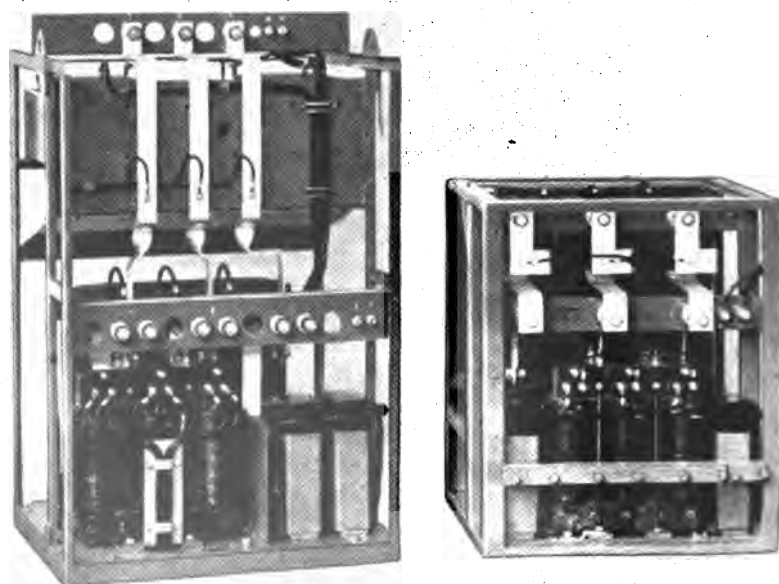


Fig. 10. Alternative static excitation units for 450 kVA 1,200 r.p.m. Siemens "Constant-voltage" alternator, with (left) selenium and (right) silicon rectifiers

⁸A further "negative-bias" control winding (not shown in Fig. 7) is fed from the main field rectifier through a preset resistor; its function is to produce an inherent voltage droop to facilitate parallel operation when under hand control.

⁹In the idealised circuit comprising the magnetising reactor in series with the parallel combination of the field winding and the capacitor, the current through the field winding is independent of its resistance.

ng reactor. The steady-state voltage regulation is ess claimed to be within the Classification usual $\pm 2\frac{1}{2}\%$ at all normal loads and at power etween unity and 0.8 lagging; because, however, rely functional nature of the system the voltage 1 is naturally dependent on the maintenance of nt prime-mover speed/load characteristic.

l operation inevitably presents a problem in any nctional system, since the a.v.r. is no longer as a convenient vehicle for low-power compensa- hough the system itself can sometimes be so as to provide inherently the required voltage ith increasing reactive load, more positive are desirable as a precaution against minor s in machine or prime-mover characteristics. The adopted for the Siemens machine is analogous usually employed for compound-wound d.c. s. Each alternator field winding is connected, a special double-pole contactor controlled by an contact on the main circuit-breaker, to a pair of r" busbars. A tendency for one machine to take in its proper share of the reactive load would be accompanied by a corresponding increase in current; but any such excitation inequality is y prevented by the parallel connection of the field and given satisfactory prime-mover charac- stable operation is thus assured. For exactly nachines the field windings may be connected o the equaliser busbars, but with unlike machines t of potential divider arrangement is presumably

the "Accurex" system, a resonant circuit is le for excitation initiation, but with the Siemens the necessary capacitor is permanently connected additional components are introduced. As has een mentioned, a capacitor tuned to resonance magnetising reactor at normal frequency is / in parallel with the field winding via the rectifier; lting amplification of the alternator residual s sufficient to overcome the "threshold" forward rop of the rectifier, and thus to initiate self-

system the alternator itself is of orthodox con- and the static excitation and control components ally supplied in a self-ventilated skeleton-frame esigned for incorporation in the main switch- ince switchboard space is always at a premium resting to note that silicon rectifiers are now offered in place of the older selenium type.

ect of the initial voltage dip the transient voltage nce of the Siemens system is generally similar f the other machines already considered, and a % with a 0.5 power factor impact load of 150%) kVA six-pole alternator is quoted as typical. t of response time, however, the performance of ns machine is apparently a good deal better than r claimed for any British machine, and recovery the order of a tenth of a second from impact the 50% to 150% range at normal induction- rting power factors are shown in a number of oscillograms. In this respect, the absence from ie British machines of a permanently connected circuit may not be without some significance.

Acknowledgments

thor is indebted to the following organisations ready co-operation: to Laurence, Scott and ctors Ltd. for information about their "Altoreg" rd for Fig. 4; to the General Electric Co. Ltd.

for information about their "Accurex" system and for Fig. 8; to Siemens-Schuckert (Great Britain) Ltd. for information about their parent company's "Constant Voltage" alternator and for Fig. 10; and to several other organisations for the provision of material which it proved impossible to include. He wishes also to thank the directors of Messrs W. H. Allen Sons and Co. Ltd. for Fig. 6 and for permission to publish this article.

(Concluded)

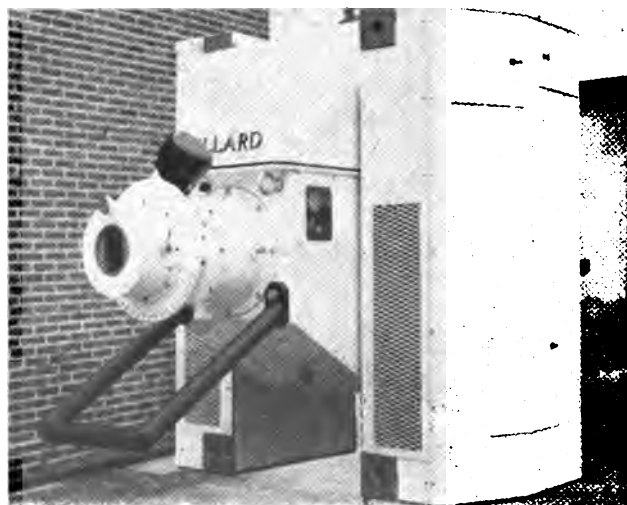
Mobile Linear Accelerator

CLAIMED to be the first mobile linear accelerator in the world, a 4.3 MeV unit for X-ray examination of nuclear power station pressure vessels has been delivered by Mullards to the UKAEA. The units give a radiation intensity of over 600 rontgens/minute at a distance of 1 metre from the X-ray source, with a focal spot less than 2 mm in diameter.

With the equipment it will be possible to obtain a radiograph through 4 in. thick steel in as little as four seconds. For 12 in. steel, exposure would be less than nine minutes. One of the advantages claimed for the unit in terms of construction site use is the absence of very high voltages. The entire accelerating process on the injected electrons is carried out in a length of 1 metre, in which electrons attain a speed of 99.5% of that of light.

The unit is self-contained and measures 8 ft 9 in. long by 4 ft 9 in. wide by 5 ft high. It weighs about two tons and can be rotated about both horizontal and vertical axes. Vacuum and cooling systems have been incorporated within the unit so that external hose connections are unnecessary. Ancillary electrical and control equipment is housed in a transportable, weatherproof structure of fibreglass which may be sited up to 250 ft away from the accelerator. First use for the accelerator is scheduled to be the CEBG's Trawsfynydd nuclear power station.

An alternative to the linear accelerator, still avoiding the use of high voltages on construction sites, might be a cobalt-60 radio-isotope source. Advantage claimed for the accelerator against such a source is that it permits radiographs of high definition to be obtained much faster for the thickness of metal likely to be encountered in nuclear power station applications.



The 4.3 MeV linear accelerator in suspended position

Turbine and compressor production

NEW FACTORY WITH ACCENT ON EXPORTS

ANTICIPATING a growth in demand for gas and steam turbines and compressors, the Hawker-Siddeley Brush group decided in 1958 to concentrate their production at a single new factory. Last week, representatives of the Press were able to see what has been achieved at the factory in the last two years.

The Press visit was on the first of three open days. Welcoming representatives, Mr G. B. R. Feilden, M.A., M.I.MECH.E., F.R.S., the managing director, expressed the opinion that in the next few years turbines and rotary compressors would find many hitherto untried applications, particularly in chemical engineering.

The new factory was, until recently, used by the aircraft industry and, in fact, the last aircraft left only in February this year. It is at Hucclecote, in the Cotswold Hills, but conveniently near to both Gloucester and Cheltenham. The floor area of 200,000 sq ft allows a fairly spacious factory layout, and the careful planning in evidence was furthered in the design stage by the use of models. The factory has a staff of 700 employees and includes key personnel transferred from the Loughborough works.

Hawker-Siddeley Brush Turbines was formed in 1959 to carry out the manufacture of steam, gas and gas-expansion turbines as well as compressors and turbo-chargers. These were previously the concern of the Brush Group. It will be recalled that the Brush Group was acquired by Hawker-Siddeley in 1957. The Brush Group had a long association with steam turbine design dating back to 1910, when they began manufacture of radial-flow turbines. In 1946, their range was extended to include axial-

flow impulse industrial turbines. In common with other manufacturers, they turned their attention in 1948 to the industrial gas turbine, and these they now produce under licence from the US firm of Clark Bros. At about the same time, they also introduced their standard range of turbo-chargers for diesel engines. More recently, they have developed the gas-expansion turbine to utilise the gas output from free-piston gasifiers.

Steam Turbines

The two types of turbine manufactured at Hucclecote are in the intermediate rating range up to about 30 MW. The radial-flow turbine has for a long time held an established place in generation. It has concentric sets of blades with alternate rings coupled and driving two alternators mounted at either end of the machine. These alternators are permanently connected in parallel. The design has several advantages—for example, the casing is never in contact with high-pressure steam and start-up can be rapid. But it also has certain limitations for use in an integrated thermal system. For this reason the company introduced their axial-flow design and these machines are available for condensing, non-condensing and back-pressure installations. A feature of their construction is the use of vortex-shaped blades where this refinement is warranted by the blade length used.

The factory includes comprehensive development and materials-inspecting laboratories and test facilities. For steam turbine testing, a Yarrow oil-fired water tube boiler

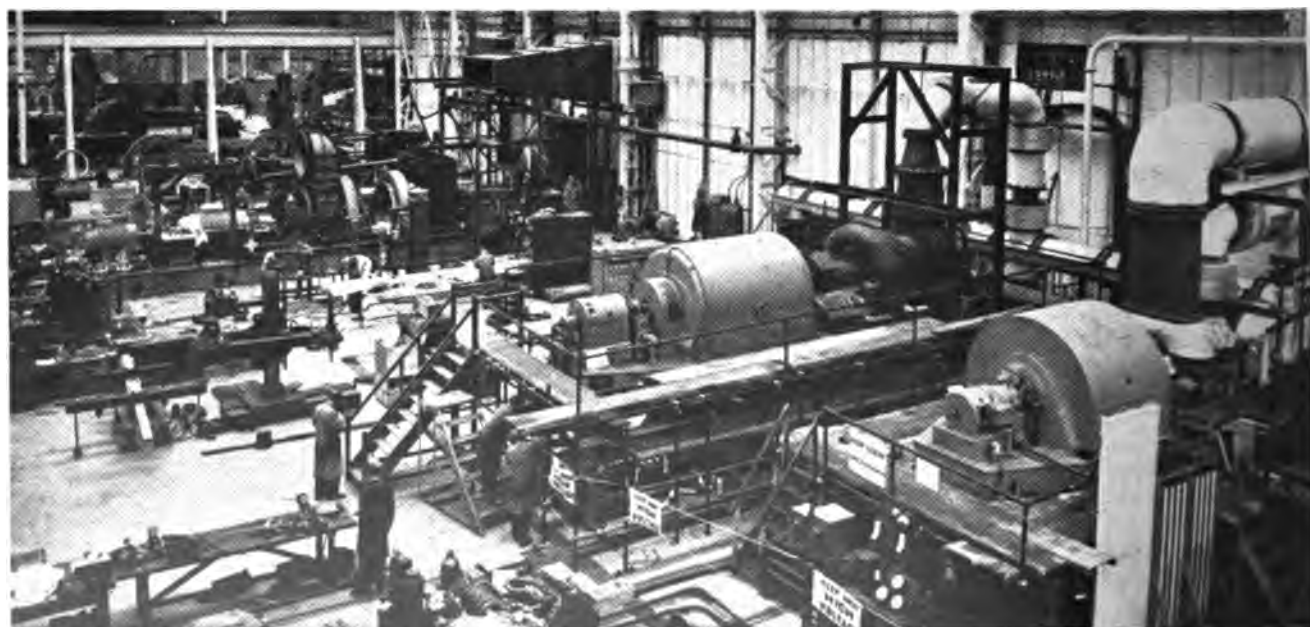


Fig. 1. The turbine erection and test area in the new Hawker-Siddeley Brush Turbine's factory at Hucclecote. On the right are the steam and gas expansion turbine test beds with access to a steam main and the gas main fed from four free piston gasifiers. A Clark gas turbine in course of erection can be seen in the background

with a capacity of 80 klb/hr at 400 lb/sq in., enables turbines to be mechanically proved. Electrical testing is also required, a load tankipation up to 5 MW. A permanent condenser but machines can also be tested with their own operating in conjunction with a 270,000 gal/hruced-draught cooling tower.

ines

nk gas turbines, made under licence, are rated 700 h.p. and 9,000 h.p. The two types being ed are suitable for pump or compressor drives generation, respectively. The turbines have und l.p. stages and are open-cycle machines y, however, be either regenerative or non-e. The complete turbine and compressor unit on a single bed plate. Air is compressed in a ial compressor and passes to a single com-umber mounted above the compressor. The hot the combustion chamber pass through ducting i turbine and may then be used for steam before exhausting to atmosphere.

t beds for these machines can each handle ated up to 10,000 h.p. Air intake is through a i ft high and two further chimneys carry away t gases. The test beds are also equipped with d Froude dynamometers capable of absorbing at 3,000 r.p.m.

ansion Turbines

expansion turbines, depending on their rating, d to operate with either single- or multiple-unit f the free-piston type. Multiple gasifier installa- le turbine powers from 1,000 to 10,000 h.p. ined. The turbines have benefited from work eed and temperature operation by the company ange of steam turbines. The expansion turbines efficiency and incorporate reaction-type vortex solid forged rotor is used, with internal heating permit rapid start-up, and a pressure-balancing sed to reduce end thrust on the bearings.

ing the expansion turbines, four free-piston re provided, each with a rating of 1,250 gas feed into a common duct and provide sufficient echanical proving tests on machines rated up to

The gas supply is at 51.3 lb/sq in. average and ause of the pulsating nature of the gas output gasifiers, flow measurements are made by a aust chimney into which the turbine exhaust is discharged.

argers

ufacture of turbo-chargers for diesel engines important part of the factory output and is at nning at the rate of ten units per week. The rs 350 h.p. to 5,000 h.p. and the chargers have ge centrifugal compressor driven by an axial- e exhausting to atmosphere. Four test cells are with a combustion chamber room running the of the test bay. There is also a compressor test rating of 350 h.p. Under test, the turbo-chargers ed as self-driving gas turbine units with a com-amber interposed between the compressor d turbine inlet.

sor characteristics for the smaller frame sizes arger are obtained by using the 350 h.p. com- rig. For the larger size units, the characteristics

are determined by using power gas from the free-piston gasifier installation.

In addition to the production test cells, two turbo-charger cells are available for development purposes. In these cells, experience has been obtained with turbo-chargers operating with a 3:1 compression ratio and with turbine inlet temperatures up to 700°C.

Research and Development

Research and development facilities have received much attention. The mechanical laboratory is fully equipped for the testing of design features before incorporation in products. The test equipment includes a 40 g.p.m. pump for the development of hydraulic control systems with pressure control up to 200 lb/sq in. and provision for temperature variation.

Ovens are available for experimental work on hot components and a pneumatic test section has been provided to enable investigations to be made on high temperature steam and gas valves which are subject to continuous vibration under working conditions.

The vibrations laboratory is equipped with electronic measuring instruments for vibration analysis on turbine blades and components. Special equipment has been developed for the continuous monitoring of vibration, displacement or other features of a turbine installation in service. This equipment can be used to give warning of excessive vibration levels or to shut down a machine if required.

An important part of the work of vibrations laboratory is checking blades and discs for resonant vibration modes likely to occur under running conditions. Vibrators are also installed for investigating casing vibration problems capable of exerting a force of ± 500 lb.



Fig. 2. In the top picture, fitters check the blading clearances on a 20 MW radial-flow, double-rotation, steam turbine. The lower illustration shows a milling operation on the joint base for a 6 MW gas turbine

OVERSEAS NEWS



from our correspondents abroad

CANADA

Columbia Project Finance

In the speech from the throne, the Federal Government indicated that Parliament will be asked to provide money for the Columbia River Hydro-electric Development, estimated at more than \$450 million. This is by far the largest of three vast public works projects in Western Canada. The speech also suggested that the Government had come to a decision on the \$60 million rail extension to Pine Point and that it is prepared to proceed on a \$80 million flood protection plan for Winnipeg.

U.S.A.

Anti-trust Law Indictment

Charges of violating the anti-trust laws have been preferred against 19 of America's largest manufacturers of electrical equipment. All but one of the defendants have offered pleas of guilty, or say they do not wish to contend the charges. The case opened on 8 Dec. and concerns annual sales estimated at £717 million, mainly to Government departments and industrial concerns. Westinghouse is named in 20 indictments and has pleaded guilty to seven, General Electric have pleaded guilty to six of their 19 indictments. Counsel for the companies say the pleas are offered, not in admission of all the indictment allegations, but to terminate what would otherwise be a long and expensive litigation.

BRITISH GUIANA

Government Acquisition

Reports indicate that the British Guiana Government White Paper shows their intention to take over the Canadian-owned Demerara Electric Co. before the end of the year. The White Paper pledges the Government to continue extension of the electricity system as far and quickly as practicable into the Colony's rural areas. It also calls for a full investigation of the hydro-electric resources. The estimated purchase price for the undertaking is \$6 million BWI. The Government proposals also provide for revision of industrial rates

SWEDEN

More Hydro-power for Sweden

Recently a preliminary regional plan for building three hydro-electric stations

with an annual output of 2,600 million kWh was presented to the Swedish State Power Board. Total cost of the scheme is estimated at £45 million, excluding transmission lines, and it is planned for completion after 1970. The stations will be erected on the upper reaches of the Stora Lule River in Arctic Sweden. This river constitutes Sweden's largest remaining power resource with a potential of over 16,000 million kWh, or nearly one-fifth of Sweden's overall power resources. Plans are already in hand to utilise 14,000 million kWh of this capacity and 3,600 million kWh are already in service through three stations. The plan envisages three power plants at Vietas, Ritsem and Voujat with heads varying from 78 to 163 metres.

European Power Exchange

Sweden intends to join the electricity power exchange scheme which already has a number of the OEEC countries as participants. By joining the scheme Sweden will benefit from seasonal and occasional power, especially from countries where electricity is generated by thermal plants. At present only about 40% of Sweden's economically usable water power is exploited even though she is one of the world's major consumers, with consumption per head of more than 4 MWh a year.

POLAND

Polish Exports to India

Motors and control equipment exported by Poland to India over the last year amounted to 400,000 foreign currency zlotys. Agreements for further supplies valued at 300,000 zlotys and also for 360,000 zlotys worth of electric meters have also been signed.

GREECE

Hydro Plant Construction

Work began recently on the new Tavropos hydro-electric station. As reported in ELECTRICAL TIMES for 27 Oct., this scheme forms one of three important power projects for long-term development of Greek hydro resources which have been inaugurated this year. The Tavropos station in the Karditsa mountains will initially have two 40 MW generators and a third will be brought

into service during 1962. Studies are also being undertaken for two further hydro projects in Macedonia on the rivers Nestos and Aliakmon.

S. AFRICA

Commissioning at Athlone

The first of six 30 MW turbo alternators at the Cape Town Athlone power station was completed at the end of October and was put on the bars in mid-November. The second of the two 284 ft high cooling towers has also reached its full height and now awaits the cooling equipment. It is not expected that the Athlone station will be generating continuously until next March when the second set is planned for commissioning.

Power Station Contracts

Contracts for the first stage of the Rooiwal power station have been awarded to A. Reyrolle for 132 kV switchgear at the fixed price of £293,453 and to English Electric Co., of SA, for 132 kV transformers at the fixed price of £189,816.

NYASALAND

Nkula Falls Project

Work may begin within the year on the first stage of the £3 million Nkula Falls hydro-electric scheme. The scheme includes a 420 ft barrage at Liwonde and a power station with 28 MW generators. A transmission line from Blantyre to Limbe will also be needed.

ZANZIBAR

Supply in Zanzibar

Although there was a falling off in trade, the annual report for the Electricity Board of Zanzibar for the year ended 31 Dec., 1959, shows a 9% rise in units generated to 9.4 million. To meet interests on the main loan it was found necessary to increase rates during the last two months of the year. Towards the end of the year a loan of £100,000 was secured for purchasing new generating sets at Saateni station and these were ordered in January, 1960. The generating capacity totals 2.9 MW of diesel plant.

UGANDA

Expert's Visit

its visitor to Uganda was Mr. E. A. R. of ERA, who is investigating uses of electric crop drying on local produce. He is also a member of other African territories.

INDIA

for Power Station

are invited from consultants to undertake the design, installation, and commissioning of the first in 84 MW natural gas thermal station at Namrup in Assam. The initially to have four 16.8 MW motors. Exhaust steam boilers provide process steam for an factory. A 66 kV transmission extending for 200 miles is in the requirements. Tenders, to be opened by 23 Dec., 1960, may be for (1) for the comparison of variation of specifications and (2) supervision of erection and commissioning. Tenders to be sent to Sita Ram, Additional Chief (Elec.), Assam State Electricity Commission, Chittagong.

in the Plan

Government of India hopes to overcome two sources of weakness in the plan which have become apparent as a result of experience in the first periods. The first two Plans take account of maintenance costs, not only for many of the projects but also for some of the added in the plans. The Government found that, in general, countries financial assistance were reluctant to assist with maintenance schemes. A deficiency in the economic development plans stems from insufficient attention on power, mining and transportation. Even though power and mining schemes have almost every credit recently

negotiated, industrial development has been so rapid that even in the Bhakra area the output from the new station is urgently required.

Repeat Order for Ahmedabad

A repeat order for a 30 MW generator set has been placed by the Ahmedabad Electricity Co. before the first set is installed. The first set is scheduled for commissioning in March, 1962, and by placing the repeat order now it is hoped that additional power capacity will be available by March, 1963. That there may be scope for even further expansion in generating capacity was stated by the chairman of the company when he announced the repeat order. The Gujarat Electricity Board have sanctioned the new expansion and the company have signed an agreement with the Development Loan Fund for \$3.9 million to cover the foreign exchange for the new plant. The turbine boiler and ancillary plant is being supplied by AEI Export, Babcock and Wilcox and Strachan and Henshaw. The annual report of the Ahmedabad Co. for the year ended 31 March, 1960, shows a 1.2% rise in unit sales over the previous year to 698.2 million. The gross profit for the year was Rs 78.4 lakhs.

Fresh Loan Sought for Karachi

To finance a power project, which is likely to come into operation in 1965, the Karachi Electric Supply Corporation will seek fresh loans. This was announced recently by Mr A. G. Khan when he presented his report for the year 1959. In the immediate future, the Corporation hope to augment generation by 15 MW in January next and a 60 MW extension to the "B" station is planned for commissioning in 1962. Present generation capacity is 53.9 MW and, as recently reported, rapid growth and demand has recently made load shedding unavoidable. Last year, power consumption rose to 15.95 crore units of which 70.13% was for industrial use. Energy sales also rose to 27.53 crore units. The Corporation's revenue for the year rose by 14% to Rs3.20 crores and profits also rose by nearly 18% to Rs32.36 lakhs.

Electrical Factory in Karachi

Next year, Siemens (Pakistan) Engineering Co. plan to establish a Rs20 million manufacturing plant for motors and transformers. The plant is expected to produce more than 10,000 motors and 2,300 transformers/year.

JAPAN

Overseas Bid Surprise

Announcement that the Tokyo Electric Power Co. is planning to buy new thermal electric generating plant through international bidding has caused surprise among Japanese electrical manufacturing firms. The president of the company said bidding would start next April and international purchase was essential because of the company's increasingly heavy financial burden. Tokyo Electric Power have advanced by five years their capital investment programme for 1959-75 and are concentrating on construction of more thermal power plants at the expense of hydro-electric generation. The president also said that construction work on the proposed nuclear power reactor must begin in 1963.

PAKISTAN

Rural Electrification Programme

It was recently announced that the West Pakistan WAPDA will undertake electrification of 8,750 villages in the future at a cost of Rs32.5 crores. 5,000 villages will be financed by the Development Loan Fund and the remaining 3,750 by the National Zonal Funds. The new plan actually covers electrification of all the 40,000 villages in the country at the rate of 1,000 a year. Already about 300 villages have been electrified. For the 8,750 villages to be electrified in the near future, consumption is estimated at 30 MW with a value for each village of about 50 kW. The cost of electrification for one village is estimated at Rs1 lakh.

AMMENTARY LIGHTING

Lighting techniques enhance the beauty of the new Uganda Parliament buildings at Kampala by night. The tall tower dominating the main entrance is a lantern comprising four fluorescent lamps. Illumination by AEI Lamp and also includes floodlights for the ground and gardens, and special lighting in stainless steel spinings, the gilded Royal Crest over the entrance. The Council Chamber, in the centre of the building, is lit by artificial lighting derived from a series of trough fluorescent lights into the ceiling. The lamps are at temperature 3,500°K and are hung from the roof space. Ambient lighting for press and public comes from tungsten wall lights. A colourful mosaic dome, lit by a beaten copper lighting fixture in the form of a sun and comet lamps, forms the ceiling of the Chamber entrance lobby.



NOTES ON WIRING

BY M E G O H M

EVERYBODY in the electrical contracting industry appears to be busy at the moment, some rather busier than others, but with enough work to go round. From this fact one assumes that installations of all sizes are going ahead and that people are really becoming electrically minded. The creation of smokeless zones mean that more people are turning to electricity for heating their homes and we now see the results of the extensive campaigns to make people become entirely "electric" in their homes. I still retain a coal fire in my lounge but for all other heating, water heating and cooking I rely on electricity. I always had the comforting thought that if my coal merchant failed to deliver my fuel I could use my electric fire.

As a result, like many others, I received rather a shock last week through the medium of the London evening newspapers, when I read that there were fears that the generating stations might not be able to handle any great increase in load if we get a really cold winter! The statement read that warnings about this had already gone out to those in authority. To those in the industry the threat is softened to some extent by our knowledge of the extent to which, even if demand does approach the limits set by generating capacity (and transmission capacity, as we are reminded during "amenity" enquiries), a significant amount of load can be shed by reduction of voltage and frequency. A drop in illumination levels, however undesirable, is better than no heat.

On the surface, this situation may not appear to be serious, but I feel that it is. Of course, if supply interruptions came back, they could undermine the confidence of the public in the electrical industry. What value has dust-free heating, clear lighting and the dozens of labour-saving electric devices if the operating power is not readily available at all times? After reading the newspaper reports, I sat in the train and listened to my fellow-travellers' comments. Many of them were just getting over a high-powered attack on their homes by one manufacturer of electrical goods. This subject may not appear to be directly connected with my normal writings but one contractor has already informed me that the public have noted the matter and are looking to other forms of heating "just in case" they suffer from "power cuts."

M.I.C.S. Cables

My recent remarks about m.i.c.s. cables and their uses in boiler houses brought me some interesting comments. One engineer asked me if I had ever experienced trouble where I had had the m.i.c.s. cable taken right into a magnetic valve. I gave a lot of thought to this question and replied firmly in the negative. I had in mind one particular installation where over a dozen such valves are installed and I know that they are all functioning. This engineer then went on to explain that such valves had given trouble some years back and after careful investigation the blame eventually fell on the m.i.c.s. cable. The explanation was that voltage surges occur during certain operations of these valves and the cable breaks down.

This may well explain the fact that many engineers specify that m.i.c.s. cable must terminate short of the

valve and require the connection to be made in some other form of cable. Personally, I have never had any such trouble, although I have taken precautions in other situations to prevent damage to m.i.c.s. cable by voltage surges. Of course, it is an easy matter to protect m.i.c.s. cable against such damage, and I feel that the manufacturers of such valves might be approached on the matter, for m.i.c.s. cables have always proved themselves beyond question where resistance to heat, etc., is required.

Warning

May I once more appeal to all electrical engineers to cast their eyes over their friends' "temporary wiring" for their Christmas tree lights, etc? I know that it is a difficult thing to do but often well worth the possible offence caused. I was partaking of a glass of cheer in a hostelry recently and noticed that the lady behind the bar grimaced every time she had to reach past a small artificial tree gaily decorated with lights. When I asked her what the trouble was I was told that the tree seemed to scratch her arm. On looking a little closer I saw that the flexible of the decoration set was perished and bare in places and that the lady was actually placing one hand on a sink whilst she reached through, or past, the tree. A few words of explanation to the landlord and the lights were disconnected. These decoration sets of lamps are, apparently, unearthed every festive season and hung on the tree, any bare patches in the wire being covered by sticking plaster. I feel certain that better care will be taken of them now.

Lamps and Fuses

Two rather revolutionary lamps have made their appearance on the market. Both are rated at 60 watt and are designed to eliminate the use of glass shades on fittings. Two shapes are available and I find them rather pleasing to the eye even when used in fittings designed for glass shades. The idea is excellent in my opinion, and although the price of the lamp is about 12s 6d I can see many people using it. For corridors and very small rooms they should prove invaluable.

There has been quite a lot of correspondence about fuses for 13 amp plugs following my recent comments and many people agree that there appears to be need for the user to be better informed. The card of fuses mentioned by me has been the subject of many enquiries. Of course, you can always find different views, and one engineer friend of mine suggests that only the 5 and 13 amp sizes are really necessary, and should be capable of dealing with the normal faults on portable apparatus. Considering this suggestion, I agree to some extent with his ideas, but think that many other engineers may feel otherwise. From my experience, there is always a feeling that the 2 amp size will protect the smaller apparatus *quicker* than the 5 amp size, even though its main job may be to protect the flexible. Of course, here again there are many different thoughts on the matter and I have in the past been involved in many arguments and, no doubt, will be involved in more now that I have expressed someone else's views in these columns.

Electrical equipment for graving dock

THREE YEAR REFITTING PROGRAMME COMPLETE

THE building of a new graving dock and refitting quay at Immingham, near Grimsby, a task commenced three years ago and just completed, involves considerable planning in that it lies adjacent to other docks which must be kept operational throughout the period. The opportunity was taken, at the same time, to change over the electricity supply from the British Transport Commission's 6.6 kV system to the 11 kV system of the YEB.

The new dock, to be known as the Henderson Graving Dock, is 600 ft long by 90 ft wide at the entrance and will accommodate vessels up to 26,000 tons deadweight. It is the largest dock between the Tyne and the Thames and will form a valuable addition to marine refitting facilities on the east coast.

Planning

The electrical programme was broken into three stages. The first involved the changeover of supply to No. 1 substation from 6.6 kV to 11 kV; the second covered the installation of the switchboard in No. 3 substation together with the cables and electrical services to the 1,000 ft refitting quay; the third and final stage was the installation of pumping and dockside electrical plant and cables in the Henderson graving dock.

The first stage covered the laying of duplicate 11 kV feeders from the YEB 33/11 kV dock area substation to opposite ends of the Crompton Parkinson nine-unit ALA/1,250 MVA switchboard. This board is split by a bus-coupler. One half supplies two 320 kVA hermetically sealed transformers—each of which is solidly coupled to existing slip-ring motors driving the pumps in No. 1 pumphouse—and one arm of the ring between the three substations; the other half supplies a further 320 kVA pump transformer and the old 500 kVA transformer, rewound for 11 kV.

The ring passes through No. 2 substation where a three-unit Crompton Parkinson switchboard supplies the existing 600 kVA transformer, also rewound for 11 kV, and a continuation of the ring main to No. 3 substation.

Stage 2 covered the installation of a nine-unit Crompton Parkinson 11 kV split switchboard in No. 3 substation. One half supplies a 750 kVA three-phase 11 kV/500 V transformer for low tension power, a 410 kVA three-phase 11 kV/500-385 V transformer for supplying shore current, the 385 V supply being derived from tapings on the 500 V winding and a 320 kVA 11 kV/500 V three-phase transformer through a remote operated solenoid o.c.b. for a dewatering pump. The second half supplies another 750 kVA transformer, another dewatering pump transformer and a transformer for supplying 55 kW and 220 kW Nevelin mercury-arc rectifiers. Both on this board and the main board at No. 1 substation, the bus couplers are locked out to prevent paralleling of the YEB 11 kV supplies.

This stage also included installation and connecting of the ten-unit 500 V 25 MVA switchboard, again split with bus-coupling facilities, and a three-unit 385 V 25 MVA board.

Services for the Quay

At the moment, a.c. shore current is supplied at 385 V three-phase 50 c/s, but space has been allocated for a voltage/frequency changer to be installed at a future date to provide a 440 V 60 c/s supply for ships with this system on board.

Ships berthed for repair, therefore, have the following supplies available from dockside weatherproof switchboards.

(a) 385 V three-phase 50 c/s unearthed up to 470 A.

(b) 110 V two-wire d.c., unearthed, up to 500 A.

(c) 220 V two-wire d.c. unearthed up to 1,000 A.

(d) 110 V single-phase, centre-point earthed a.c. up to 228 A.

(e) 500 V three-phase three-wire 50 c/s a.c. to supply three- and six-operator welding transformers or generators.

Similar services will also be available in the graving dock via the service tunnel.

Henderson Dock Pumphouse

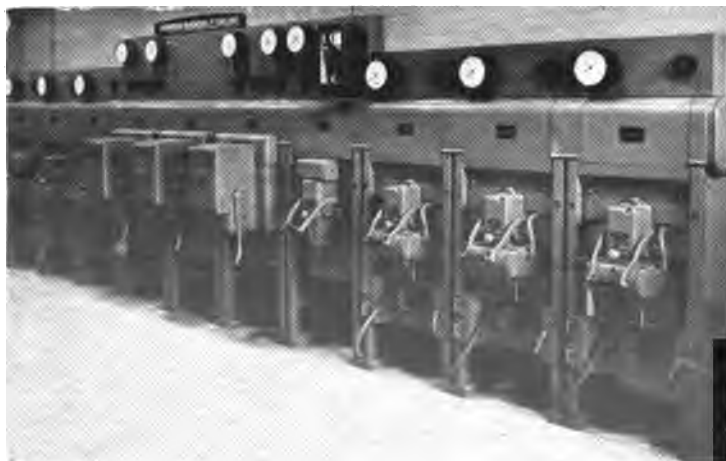
The two main dewatering pumps in the Henderson Dock pumphouse are driven by 385 h.p. 500 V three-phase squirrel cage motors solidly connected to 320 kVA 11 kV/500 V hermetically sealed transformers with power factor correction up to 0.94 provided by 100 kVAR tank-type capacitors.

Each unit is switched direct on line by remote-controlled solenoid-operated oil circuit-breakers on the No. 3 switchboard, the starting current being approximately $4\frac{1}{2}$ times full load current. Auxiliary drives, which include one 115 h.p., three 80 h.p. and a number of other motors ranging between $1\frac{1}{2}$ h.p. and $12\frac{1}{2}$ h.p., are controlled from the operating platform on an Allen West starter switchboard. Remote switching of the main pumps is also controlled from this position.

Ring Main and other Cables

The ring main is of 0.1 sq in. cross section and terminates at the control position in No. 1 substation in oil circuit-breakers. On the boards in the other two stations, connection is through fault-making, load-breaking isolators. Under normal operation, the ring is split at No. 3 substation with each YEB feeder supplying half.

Cables are all of Crompton manufacture, this company being the main electrical suppliers. The electrical consultants were R. W. Gregory and Partners of Newcastle upon Tyne.



Crompton Parkinson 10 unit 25 MVA switchboard in No. 3 substation



View along the dock servicing tunnel showing cables

Checking Characteristics

Electric Arc Furnaces

ACTICAL METHOD FOR STEELWORKS INVESTIGATIONS

ETHODS of determining the electrical characteristics of steel industry arc furnaces are discussed in a paper* which was presented at the Utilisation Section of the Institution of Electrical Staff. The electrical staff may wish to determine these characteristics, but not necessarily in working conditions. One of the main points of the paper is that a simple method gives reasonably good agreement with results obtained from complete tests.

Characteristics

Shows typical electric-arc furnace characteristics. For any given voltage tap, the arc power increases as the electrodes are moved closer together. It levels off and finally decreases as the current is further increased. The power dissipated in the electrodes, also increases at first and then decreases. The peak in power characteristic represents the useful power which can be obtained from the given transformer for the circuit conditions. The current corresponding to maximum arc power is usually called "optimum current" for that

considered that the electrical efficiency is otherwise than in the case of useful work, then the efficiency of the installation is the ratio of arc power to total circuit power. The electrical efficiency decreases with increase of furnace load, but rapidly after the arc power has reached its maximum. Overall circuit efficiency or also falls steadily with increase of current. It is obvious that the best way to determine the electrical characteristics of an arc furnace is to make measurements as close as possible, changing control and settings to enable relatively small adjustments to be taken. For a full test, the electrodes are just inside molten metal in the furnace. Measurement of arc power is difficult because of the problem of determining arc voltage. Techniques for solving this problem have been developed but they are not considered suitable for large production

Whatever method is used, it remains true that the complete circuit-power and arc power curves cannot be determined because of the dangers of overloading the furnace transformer in taking the necessary readings. The solution suggested in the paper is to use an equivalent circuit of the arc furnace at least to fill in the blank parts of the characteristic curves.

Equivalent Circuit

An equivalent circuit for an arc furnace is shown in Fig. 2. Each phase of a three-phase furnace can be represented for a given voltage tap, by an a.c. series circuit, including:

- (1) A fixed inductive reactance, consisting of the inherent reactance of the furnace transformer, the supplementary reactor and the reactance of the furnace cable and busbars.
- (2) A fixed resistance consisting of the transformer windings, cables, busbar resistance and the electrode.
- (3) A variable resistance represented by the arc itself.

In the equivalent circuit shown, X_1 to X_3 and R_1 to R_3 can be determined during the short-circuit tests. It is then possible to determine points on the characteristic curves in terms of formulae which the paper develops. However, success of this method is entirely dependent on the degree of accuracy attained in measurement of the furnace constants during the short-circuit test. A complication is the change in a.c. resistance and mutual inductance which can occur when heavy currents flow during short-circuits. A change of this sort means that furnace constants derived from short-circuit tests will differ from those operating within the normal current range. It is suggested in the paper that this effect is not significant for furnaces of up to 25-ton capacity.

In making measurements on arc furnaces, it should be kept in mind that although currents are kept approximately equal in the three phases by the regulator during normal working, during short-circuit they may become quite unbalanced. In measurements on a 10 cwt experimental furnace, currents of 3,140 A, 4,560 A and 4,300 A were recorded during a typical short-circuit test with 20 V furnace voltage and 184 kW furnace power.

It can be shown that maximum circuit power occurs when the sum of the circuit resistances equals the sum of the circuit reactances.

It is clear that the determination of furnace characteristics by the method

described involves considerable work. Moreover, tests may be difficult to perform on production furnaces, due to the interruption in production entailed in taking a series of observations under flat bath conditions, especially if high power inputs have to be measured. Multiple short-circuit tests required to determine phase voltages and power per phase are also detrimental to the steel-making process.

Simple Method

The paper suggests a simplified method of calculating furnace characteristics, based on treating the furnace as a balanced three-phase load. It claims that tests have established this method as being sufficiently accurate for all practical purposes.

For the simplified method to be used, it is necessary that the furnace should

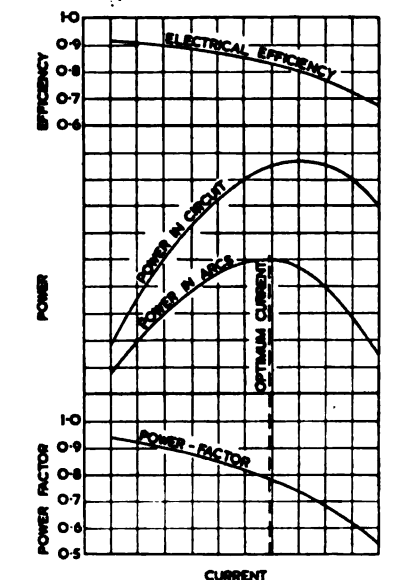


Fig. 1. Typical characteristics for electric arc furnace in steelworks

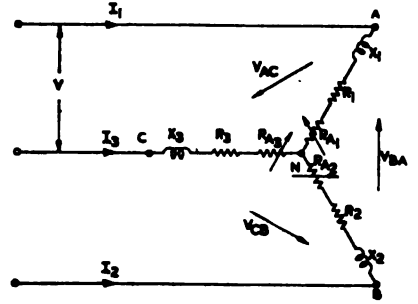


Fig. 2. Equivalent circuit for a three-phase electric arc furnace

per 3328: The Determination of Electrical Characteristics of an Arc Furnace. J. Ravenscroft, B.Sc., A.M.I.E.E. J. Ravenscroft is with Steel Peech and was formerly with BISRA.

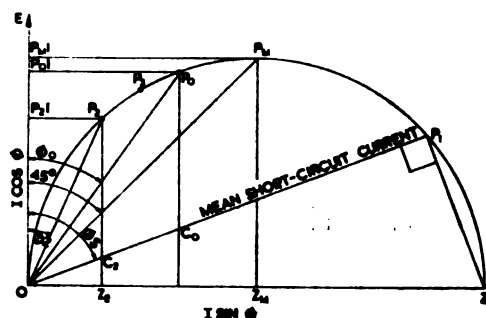


Fig. 3. Current-locus diagram based on measurement of short-circuit current

be equipped with an h.v. line voltmeter, an ammeter for each of the three phases, and a double-element indicating wattmeter or a power-factor meter. These instruments are needed for measurements as the three electrodes are dipped simultaneously into a molten-steel bath. From the readings observed, input apparent power and short-circuit power factor can be calculated. Only one short-circuit test is required for each voltage tap.

Current-locus Diagram

Observations taken during tests are used to construct a current-locus diagram such as that shown in Fig. 3. If the arc-furnace circuit is considered as a simple a.c. series circuit of constant input voltage, constant inductive reactance and

variable resistance, then the locus of all possible current vectors lies on a semi-circle. This may be constructed by drawing each short-circuit current vector, e.g., OP_1 at angle φ_s to the vertical, where φ_s is the phase angle at short-circuit. P_1Z drawn at right angles enables the diameter of the circle to be found, since there is a right angle between the vertical voltage vector and OZ . All operating points P_2 , P_3 , etc., then lie on the semi-circle, and other values such as circuit power, arc power, electrical efficiency can be obtained from the diagram by application of suitable formulae and geometric constructions.

When characteristic curves were plotted for the experimental furnace previously mentioned, on a basis of the current-locus diagram described, it was found that for both circuit power and arc power characteristics there was little difference between the results obtained by the two methods. For example, on the 130 V tap, the circuit power for an electrode current of 2,500 A was determined from the locus diagram as 554 kW, which compared closely with the value of 558 kW calculated on the basis of more complete tests. Optimum currents determined by the two methods will also be found to be similar. 3,685 A given by the locus comparing with 3,750 A on a basis of measurement.

Conclusions

In comparison of the methods available for determining furnace performance it is suggested that the direct method has limited application for production furnaces. If a series of short-circuit tests can be made to determine furnace constants without interfering too much with production, the complete characteristic can be derived by calculation using simple formulae. The success of this method, however, is entirely dependent on the accuracy of the measurements during the short-circuit tests. Performance curves can be drawn reasonably accurately by using a current locus diagram plotted from data obtained from a single short-circuit test. Provided working current is well below the optimum level, this simple technique gives close agreement with results obtained by the two other methods.

The paper reports experimental work on a 10 cwt furnace which confirms these conclusions. The comment is made that if circuit reactance is high the load current can approach or exceed the optimum value, and it is important that the optimum currents should be forecast accurately so that the load does not exceed these values during normal operation of the furnace, and so waste power. Characteristic curves for the 10 cwt furnace in fact show that it is most efficient when operated on the highest voltage tap.

Sealed transformers in extreme conditions

IF the tank of a transformer is hermetically sealed, the conservator or similar equipment to take care of breathing may be omitted. Some while ago, the Shell International Oil Co. bought 15 transformers of this type from C. A. Parsons, and installed them in Sumatra in the Far East. One of these transformers was returned to the works after nine years' service for examination to establish the performance of this type of design in extreme conditions.

Like others in the batch, the transformer was installed in an open unprotected situation, in the tropical sun. It was subjected to fluctuating loads (domestic supply) with high peak loading during the daytime.

The transformer was a 100 kVA three-phase 50 c/s unit for ON cooling in a plain tank. It was arranged for 6,300-3,150 V primary (series-parallel) and 220 V secondary. Tappings were provided for $\pm 2\frac{1}{2}\%$ and $\pm 5\%$ on the h.v. winding. Cable boxes were provided for both h.v. and l.v. windings. The oil used was Shell Diala B.

Preliminary Tests

Testing at the C. A. Parsons works took the form of preliminary tests before the transformer was opened, followed by

piercing the sealed case and the carrying out of further tests on the transformer and on oil samples.

The initial tests showed satisfactory insulation resistance between h.v. and l.v. windings and earth, and a satisfactory dispersion (a measure of the insulation power factor) when cold. When the transformer was hot, and a positive pressure presumably existed in the gas space above oil level, the transformer was thoroughly examined for indications of leakage at all joints, particularly the cable box bushings. No signs of leakage were found.

Breaking the vacuum seal was carried out by drilling the cover through a special drilling device that would permit holding the vacuum presumed to exist at normal ambient temperature. In fact, a vacuum of 4.4 in. mercury ($12\frac{1}{2}$ lb/sq in. absolute) was found to exist at a temperature of 67°F. The cold oil level was found to be correct to within about $\frac{1}{4}$ in. of the mark to which the transformer had been filled before sealing.

Oil samples were found to be generally satisfactory. An independent test showed the samples to be slightly acid, but the opinion was expressed that a large part of the acidity was due to the presence of dissolved varnish acids in the oil. The

inside of the tank was painted with copal varnish.

Internal Condition

When the cover weld of the tank was chipped off (the operation took about an hour) inspection of the cover showed the condition of the internal painting "as good as new." Close inspection of the oil surface showed small traces of surface contamination adjacent to the tank walls. These were presumed to be from the varnish coating of the tank.

To remove the core and windings it was necessary to lower the oil level to permit access to bushing connections. When through-tank bushings were removed, Neo-K-Tex gaskets were found to be in sound, pliable condition.

Core and windings, when lifted from the tank were in a clean condition with no deposits on any of the horizontal surfaces. Windings were "fairly dark" in colour, but otherwise in new condition. End packing on windings was tight, and there was no sign of deterioration of off-circuit tapping and series-parallel switches. Inspection of the tank after pumping out the oil showed all internal surfaces to be clean.

Overall, the verdict on the transformer was "excellent condition."

A.E.I. A.S.D. Air-Break Starter



THE apparatus illustrated is a simple, manually operated star-delta starter designed for the infrequent switching of three-phase six terminal squirrel cage motors. Its general design is very similar in many respects to that adopted by other makers. Indeed, it is quite apparent that control gear tends, by necessity, to follow established practice which is modified to suit the particular ideas of each manufacturer.

General Construction

The case and lid of this starter are die-cast. The cover, which is not shown in Fig. 1, is not hinged, and is retained by four screws.

Three conduit entries, covered with gland plates, are provided: one at the top left side of the case and two at the bottom, while a blanked hole on the top of the starter permits the fixing of an ammeter should it be required.

This dust- and damp-proof enclosure houses a typical drum-type starter, operated by a lever on the right-hand side. Depressing this lever connects the motor in star for starting, elevating the lever changes the connection to delta for running. The usual gravity device is incorporated to prevent the handle being inadvertently placed in the running position without first pausing in the starting position.

Once the motor is running correctly the catch on the u.v. relay retains the starter hand in the vertical position. A small lever on the top right of the case will trip the starter.

The inside of the cover carries a connecting diagram, die-cast in the metal itself.

Drum Switch

The main body of the drum switch is a bakelite moulding, fixed by two cheese-headed screws to the back of the case. This moulding carries the two sets of fixed contacts and the three overload relays. The drum switch is also a moulding and does not consist, as in many other starters, of a number of contacts and insulated spacers threaded on to a steel bar. In the present starter the moulding itself forms a strong insulated bar to which the moving contacts are bolted. One end of this moulding engages a dog drive operated by the starting handle and the other end is supported by a pivot screw (A) which passes through the side

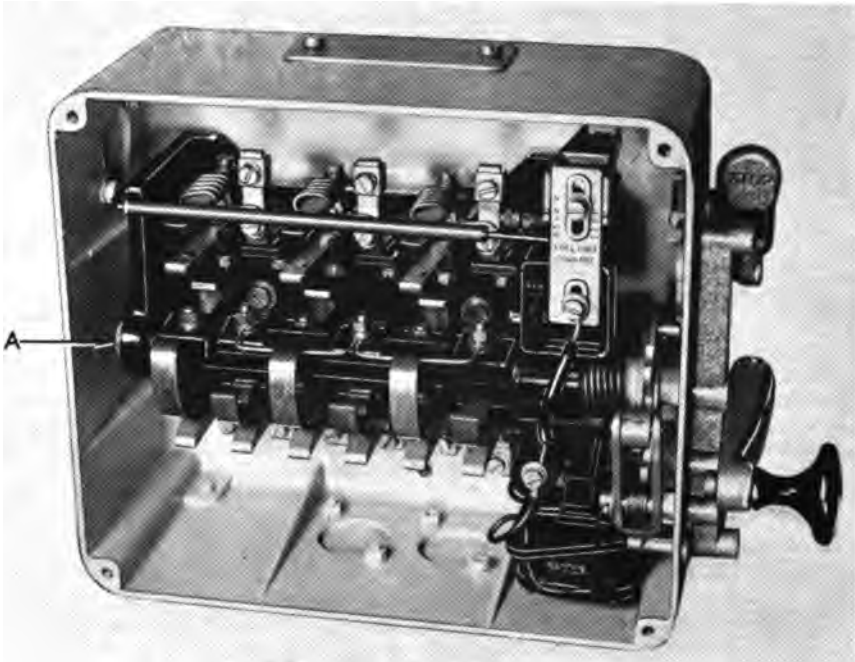


Fig. 1. Interior of AEI air-break star-delta starter

frame of the main moulding. (See Fig. 1.)

A portion of the drum switch is drawn in Fig. 2 which also shows the cavity for the dog drive (1). The moving contacts are formed from copper strip. One of the fixed contacts is included in Fig. 3.

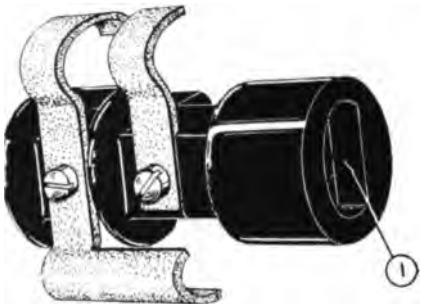


Fig. 2. Part of drum switch seen at bottom of Fig. 1

Under-voltage Relay

In starters of this type the u.v. relay performs two functions; it retains the handle of the starter in the running position once the motor has been started, and it will release this handle and so switch off the starter when the volts fail, or drop below a predetermined level.

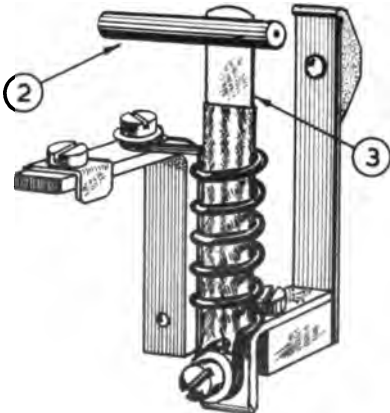


Fig. 3. Fixed contact associated with drum switch, and o.l. heater. In the starter this is at right angles to position shown (Fig. 1)

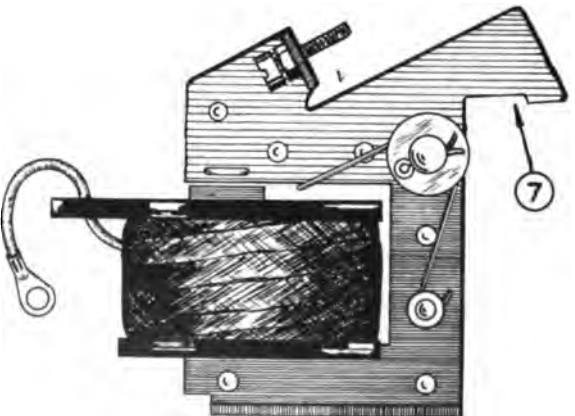


Fig. 4. Under-voltage relay, bottom right of Fig. 1

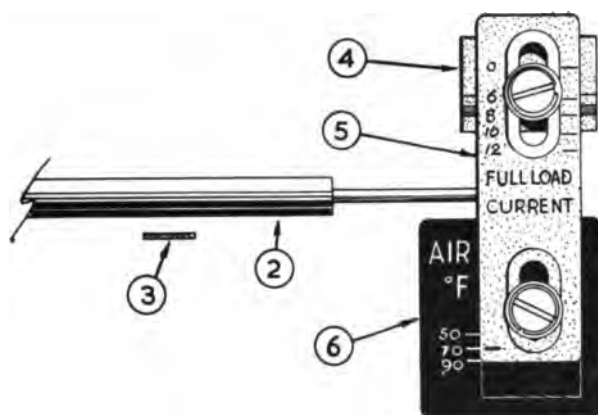


Fig. 5. Contacts associated with under-voltage relay

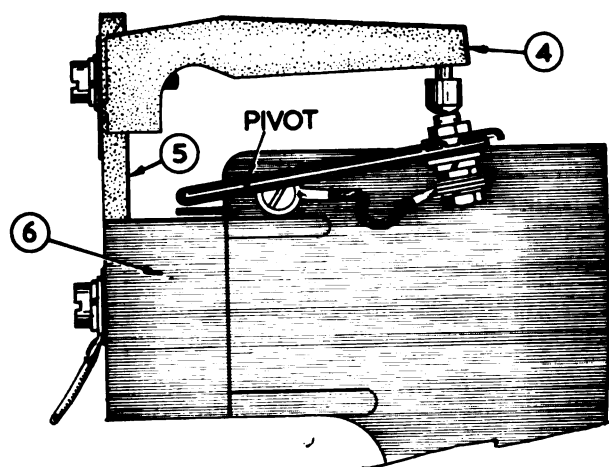


Fig. 6. Bracket (4) of Fig. 5 in front elevation

Fig. 4 shows that this u.v. relay is of the normal clapper type with the armature extended to form a hook (7) which engages the handle linkage. The coil itself is wound on a moulded former and is retained on the stampings by a U-shaped wire spring. Each coil carries a copper strip bearing a code number but not the coil voltage. A wide range of coils is available for this starter, covering voltages from 47-675 and frequencies 50 or 60 cycles.

Overload Relays

In the example illustrated, the overload relays use a thermal bimetal strip. The three units can be seen in the photograph at the top of the main switch moulding and one item is shown in detail Figs. 3, 5. It is a very simple device with a heater spiral surrounding a bimetal strip (3) which is free to move. Excessive

current will cause the bimetal strip to bend and move the trip bar (2). This trip bar actuates a pair of contacts in series with the u.v. relay and these are shown in detail in Fig. 6. The trip bar is pivoted as indicated and carries one contact at its extreme end. The other contact, which is spring loaded, is attached to a die-cast bracket (4) whence current is carried, via a second die-casting (5) to the auxiliary circuit.

Fig. 5 also shows bracket (4) in front elevation where the method of attachment is illustrated. The position of the bracket can be varied to give different current settings. Compensation for ambient temperature is effected by another adjustment where the whole die-cast assembly (4) and (5) can be moved according to the calibrations on the bakelite body (6) which carries the trip contact assembly.

Other models of this starter are fitted with magnetic overload trips.

Maintenance

There is little to go wrong with a starter of this kind. Dismantling is simple and the removal of the pivot screws (A) (Fig. 1) enables the switch drum to be removed.

The rest of the starter is equally accessible.

It is, however, worth while to quote from the instruction handbook: "The working face of the contacts inevitably become roughened and pitted in service but this is not detrimental to their efficiency. Any large blobs of copper that may have formed should be removed, but it cannot be too strongly emphasised that it is not necessary to file the contacts to a smooth finish."

FIRE RISKS WITH ELECTRICAL MATERIALS

IT is not always realised that p.v.c. carries risks of damaging metals if it should be involved in a fire. The October number of *FPA Journal*, published by the Fire Protection Association, reports a fire in Denmark in which this was unfortunately well demonstrated. The fire involved a storage department of a factory making electronic instruments and television equipment. It started in an office, and only part of the storage area was directly damaged by fire. However, on the shelves were some components made from p.v.c. weighing in all about 55 lb.

Corrosion

When involved in a fire this amount of p.v.c. will produce about 350 cu ft of gaseous hydrogen chloride, and this will dissolve in water to form hydrochloric acid, which is extremely corrosive to most metals. As a result of the fire, the hydrochloric acid corroded all

the ferrous metal parts of the equipment in the store except those which had been coated with a thick layer of nickel. Components covered with thin layers of cadmium or zinc were severely damaged and brass and copper parts were also damaged. Even lacquered surfaces were attacked to the extent of their corrosion resistance being affected.

The damage to the structure of the building amounted to £5,000 but the damage to the contents, which was almost entirely by corrosion and not by fire, amounted to £150,000.

Sprays for Rubber

Other materials widely used in electrical engineering also introduce fire risks, although not so unexpectedly. Rubber is an obvious risk, and the same number of the *FPA Journal* recommends that a sprinkler system giving a water spray should be installed in the dough-mixing section where rubber compounds

are being prepared. The system should preferably be such that in the event of a fire in one hopper, a water screen can be discharged round it. For extinguishing fires in hoppers, carbon dioxide systems, fixed and preferably manually operated, are suitable.

Machining Aluminium

Freshly machined aluminium introduces a risk since it oxidises in contact with moist air. In the case of swarf, however, the heat generated is insufficient to cause ignition. Aluminium dust particles, because of the greater surface area they present, are a different story.

Chromium plating is judged to present little fire hazard, despite the evolution of hydrogen from the acid solution. The recommended precaution for dealing with this is provision of high-level extraction plant as part of the ventilation system.

Commerce House, Birmingham

CTRICAL EQUIPMENT IN OSING NEW BUILDING

WHEN a group of people got together in Birmingham in 1783 to form the Birmingham Commercial Committee, they little knew that they were laying the foundation of a movement which, 177 years later, was to have associates in every important town and city throughout the country, the Chambers of Commerce. Originally, the name dates from the reformation of the body in 1813 after the original committee had fallen out among themselves, but the new Chamber never again looked back. It was the impact of the organisation that it soon had other towns copying until, in 1860, the Association of Chambers of Commerce was formed. This year, marking the centenary of that act, Birmingham again shows its leadership by moving into the new premises, to the design of Mr H. D. Madin, A.R.I.B.A., which they have erected, at a cost of £500,000, in Harborne Road, Edgbaston. The new building, T-shaped in plan, comprises a stem, four stories high, in which the main Chamber suites are located, and an eight-storey commercial block as the bar, which is let out to business houses and others requiring office accommodation. Among the latter is the United States Consulate and the British West Africa Corporation.

Chamber and Offices

The Chamber offices include a Presidential Suite, the Council Chamber, meeting rooms, library and information centre and administrative sections. There is also a Chamber of Commerce club and on the roof a penthouse lunch bar. Around the building there is ample car-parking.

The council chamber is a handsome room 75 ft long by 15 ft wide with acoustics so excellent that microphones are unnecessary. By night, light is from 12 semi-recessed GEC



lighting units with six 4 ft Osram Warm White tubes on switchless-start circuits. The President's room is lit by standard 6 ft by 2 ft recessed module fittings, while other executive offices are illuminated by 6 ft by 2 ft recessed module fittings.

Electrical Services

Supply is taken from the MEB at 400/230 V from a substation in the basement which also serves part of the surrounding district. Two 500 A ironclad GEC switches serve rising mains to the Chamber and business blocks from which distribution to each floor is via skirting board trunking with cross-trunking in the ceiling for lighting. Each of the floors in the business block is arranged for separate metering to tenants with a maximum of four tenants per floor. Telephone circuits are segregated in separate trunking.

The main cables are v.r.i.-insulated with a proportion of m.i.c.c. in subsidiary circuits. All lighting switches are of the "Britmac" silent pattern.

Lighting throughout has been planned to give a higher-than-average level of 30-35 lumens/sq ft, most of which is by switchless-start fluorescent fittings; 60 W tungsten filament lighting is used in the entrance halls.

In the eight-storey building there are three 300 ft/min passenger lifts and, in the commerce block, two 200 ft/min passenger lifts. There are also a goods lift and a service lift. All lifts are by the Express Lift Co. and incorporate the latest system of Express traffic control. The internal telephone system comprises two master stations and 11 substations with transistorised amplified loudspeakers and sensitive microphones to allow of hand-free conversation on the masters.

Other interesting electrical features include a 500-station automatic fire detector system and under-ramp electric heating to prevent the formation of ice on the approach ramps outside the entrance.

The main electrical contractors were Parker Winder and Achurch, and the GEC supplied most of the electrical equipment.

A view of the handsome 75 ft long council chamber in Birmingham's new Chamber of Commerce building. By day the curtained area is an unbroken window space. By night illumination is from the GEC semi-recessed fluorescent lighting fittings



Personalities *in the industry*



Mr H. J. Unwin



Mr A. M. Hudson Davies



Mr A. P. Harvey



Mr D. A. Laverack



Mr E. J. Haslock

Mr H. J. Unwin, A.M.I.E.E., has been appointed assistant chief commercial officer (sales development) to the Eastern Electricity Board, with responsibility for the promotion of sales of load development appliances and improvement of retailing techniques in the Board's show-rooms (*ESH, pages 105, 107). Mr Unwin started his training in 1932 as an engineering apprentice with the BTH Co., Rugby, and later worked with them as a research engineer until the outbreak of the war, when he took a commission in the electrical branch of the RNVR. He entered the supply industry after the war and has held commercial posts with the Cambridge Electric Supply Co. and with the Eastern Electricity Board in the Fens sub-area and at their headquarters. In 1957 he was appointed manager of the Board's Thurrock district, which he leaves to take up his new appointment on 2 Jan. next. Early this year Mr Unwin attended a three-month management course at the Administrative Staff College, Henley. He was chairman of the Board's working party created last year to investigate and make recommendations upon procedures for acquiring sub-station sites and wayleaves.

Mr A. M. Hudson Davies, O.B.E., M.A., F.I.W.M., has been elected chairman of the Institution of Works Managers for 1960-61, with **Mr J. Ayres**, M.I.E.E., M.I.P.E., managing director, Simms Motor Units Ltd., as deputy chairman and **Mr H. E. Drew**, M.BRIT.I.R.E., M.I.P.E., director of electronic production, Ministry of Aviation, again as honorary treasurer. Mr Hudson Davies became managing director of Fibreglass Ltd. in 1946, and joined the board of Pilkington Group Ltd., the parent company, in 1952.

Two power station superintendents with the London Division of the CEB are to retire at the end of March next. They are **Mr A. W. Dunbar**, at Lombard Rd. and **Mr D. Halliday**, A.M.I.E.E., at Woolwich (*ESH, page 57). Mr Dunbar will have completed 50 years' service in the industry. He has been station superintendent at Lombard Rd since 1930,

and was previously at Blackwall Point, at Bow and, earlier, with Metropolitan-Vickers. Mr Halliday has been station superintendent at Woolwich for the past ten years and has served there since 1923.

Chief engineer of the Switchgear Division of the Brush Electrical Engineering Co. Ltd. since 1955, **Mr A. P. Harvey**, A.M.I.E.E., has transferred to Bristol Siddeley Engines Ltd. as senior electrical engineer. He originally joined the Brush Co. in 1953, after eight years in the electricity supply industry, first with the CEB, South East England Region, as a technical engineer and, after vesting day, with the Eastern Division of the CEA as a regional technical engineer. Mr Harvey served his apprenticeship with A. Reyrolle and Co. Ltd. and joined their Technical and Research Department in 1934.

Mr G. J. Rackham, a director of Simms Motor and Electronics Corporation since 1950, has resigned for health reasons.

Mr John C. Garrels, jr., has been appointed deputy managing director of Monsanto Chemicals Ltd.

The Electric Construction Co. announce that, for health reasons, **Mr Dennis A. Laverack**, M.A.M.E.M.E., is to relinquish duties as area manager for Yorkshire as from 1 Jan. next, but he will continue to act in a consultant capacity within the area. His successor as area manager will be **Mr E. J. Haslock**, A.M.I.E.E., M.A.M.E.M.E., who has been Mr Laverack's assistant since July, 1958. Mr Laverack was educated at St. Peter's School, York, and subsequently became an articulated apprentice with the company in 1916, receiving training in all departments of the Wolverhampton works. During this period he became chief student of the Wolverhampton and Staffordshire College. Following Test Department service he was attached to the Works Estimating Department from 1923-27, preparing tenders and contracts for all types of rotating machines and

switchgear. In 1927 he was appointed outside sales engineer in the counties of Derbys and Notts, with headquarters at Derby, and afterwards he was transferred to take charge of the Yorkshire area. When the company opened area offices at Leeds, in 1958, Mr Laverack became area manager. Mr Haslock trained with Siemens Brothers and Lancashire Dynamo and Crypto, and gained other technical training at Hackney Technical College. From 1941 to 1950 he was contracts manager for Bryce Electric Construction Co., later becoming area manager in East Midlands and Yorkshire for Bryce Electric and Hackbridge Cable Co. Ltd. He joined ECC in 1958.

Mr W. C. Balle, W. T. Henley's area board representative maintaining contact with the Midlands Electricity Board, was presented at Birmingham with a convector heater and an electric kettle by **Mr W. L. Willey**, cable regional sales manager, Birmingham, on behalf of friends and colleagues in the area. At the Hatton Garden office in London he received a letter of appreciation from the company, together with a cheque subscribed by his colleagues—presented by **Mr F. V. Valsiere**, commercial manager, AEI Cable Division, to mark his retirement.

District engineer in the Taunton district, Electrical Department, South Western Division of the CEB, **Mr L. F. M. Baker**, B.SC.(ENG.), M.I.E.E., has retired. His successor is **Mr C. L. Chalk**, B.SC.(ENG.), A.M.I.E.E., formerly assistant district engineer at Taunton. Mr Baker started in the electricity supply industry in 1923 as a district engineer with the South Wales Electrical Power and Distribution Co. In 1932 he joined the CEB as a transmission section engineer at Bridgwater and continued in that position until 1959 when he was promoted to district engineer on the formation of the Electrical Department. He has served on many committees and was chairman of

* Denotes revision to the "Electricity Supply Handbook, 1960."

pply Group of the IEE Western in 1956. His retirement was by the presentation of an electric , toaster and picnic basket at a n at the SWEB social club, and frigerator by the Divisional Con- Mr H. S. Davidson, on behalf agues and friends, at a dinner at rand Hotel, Bristol, which Mr Thirtle, Regional Director, also d.

or changes in the board of Morphy- ds Ltd., following the acquisition : business by EMI, are now ced. Mr F. P. Bishop, the chair- has resigned from the board at n request and has been replaced irman by Sir Joseph Lockwood, an of EMI. Mr D. L. T. Oppe as resigned and Mr J. E. Wall, ing director of EMI, has become :tor. Mr C. F. Richards, who has joint managing director since the ion of the company in 1936, has up that post and left the board er to pursue other interests but enefit of his experience and advice en secured to the company in a ing capacity." Mr D. W. Morphy elinquished the post of joint ing director, at his own request, ll remain a director of the com- Mr W. Roxburgh—managing direc- : Morphy-Richards (Astral) for years and a director of the parent ay since 1959—has been appointed anaging director. Mr H. W. A. as, director and general manager rphy-Richards (Cray) and Mr Z. , director and general manager of y-Richards (Astral), have been ted to the Morphy-Richards board. l be recalled that the original f EMI for the M-R capital was y opposed by three of the five rs, Mr Bishop, Mr Richards and ppe, and was supported by Mr y and Mr Roxburgh. Mr Griffiths oined Morphy-Richards last April eral manager—some three months the takeover bid—and was pre- manager of the Instruments Divi- f Evershed and Vignoles Ltd. ager of the Woking district of the Eastern Electricity Board since Mr E. Peel, M.I.E.E., has been ted manager of the Board's Sut- trict to succeed Mr W. B. Hayden, , who is retiring on 7 April, 1961 , page 85). Mr Peel, who is 44, is



Mr W. Roxburgh



Mr T. L. Watman



Mr J. M. Storey

a Lancastrian and received his technical education at Blackburn Technical College and Regent Street, London, Polytechnic, starting his career as a trainee with the electricity department of Blackburn Corporation. After war service as an officer in the RAF electrical engineering branch he was appointed as a mains assistant with Hammersmith Corporation, and later became a first assistant district engineer with the London Electricity Board. He joined Seeboard in 1954 as district engineer at Woking.

Mr T. Lisle Watman, A.M.C.T., A.M.I.E.E., has been appointed director and general manager of the Indian National Diesel Engine Co. (INDEC), Calcutta, an associate company of Hawker Siddeley Industries, to set up facilities for the manufacture of Petter diesel engines under licence in India. He will be leaving his present post as executive assistant to the joint managing directors of Hawker Siddeley Industries in January, 1961. Before joining HSI in 1959, Mr Watman had served as technical adviser to the Carborundum Co. Ltd. and as assistant chief engineer with Colgate-Palmolive Ltd. He later headed a reactor design team for the English Electric Co. and served as a technical co-ordination engineer for their consortium in London.

Assistant sales manager (power cables) to BICC since last March, Mr M. H. Beattie, E.R.D., M.I.E.E., has been appointed commercial manager, British Insulated Callender's (Submarine Cables) Ltd. Educated at Glasgow and Kelvin-side Academies and the Royal College of Science and Technology, Glasgow, Mr Beattie joined Scottish Cables Ltd. after war service. From 1948 until

March this year he was their London sales manager. In his new post Mr Beattie will be located at 21 Bloomsbury St, W.C.1.

Mr James M. Storey, C.B.E., managing director of Dewrance and Co., a subsidiary of Babcock and Wilcox, will retire at the end of December. Mr Storey was leader of the Economic and Goodwill mission to the Canadian Petroleum and Allied Industries in May, 1957. He was awarded the C.B.E. in January, 1959.

As we briefly reported last week, on the retirement of Mr J. J. Gracie, C.B.E., LL.D., M.I.E.E., at the end of this month (as we intimated on 7 July last) Mr T. H. Kelsey, M.A., M.I.E.E., will become general manager of the General Electric Co.'s engineering works at Witton and Mr W. D. Morton, M.A., A.M.I.E.E., A.M.I.MECH.E., is to be assistant general manager as from 1 Jan., 1961. Mr Kelsey, who was born at Gainsborough in 1905 and educated at Uppingham and Downing College, Cambridge, joined the GEC at Witton in 1929. In 1932 he moved to the company's Manchester office and, in 1935, became assistant branch engineer at the Liverpool office. In 1940 he returned to Witton, where he was responsible for the section of the Materials Control Department concerned with high priority contracts, until 1942. He then joined the Ministry of Supply and, in 1944, became deputy director in charge of the Directorate of Industrial Electrical Equipment (DIEE Machine Tool Control). When the Machine Tool Control was closed down in 1946, Mr Kelsey became director of disposals but, in 1947, he returned to the GEC as their representative at BEAMA and became a mem-



E. Peel



Mr M. H. Beattie



Mr J. J. Gracie



Mr T. H. Kelsey



Mr W. D. Morton

ber of the BEAMA Contract Conditions and Materials Committees. In 1955 he was appointed technical assistant to Sir Harry Railing and, on Sir Harry Railing's retirement, personal assistant to Mr A. L. G. Lindley. In 1958 he became assistant general manager at Witton and, in June, 1960, deputy general manager. Mr Morton, who was born at Killmarsh, near Sheffield, in 1924, was educated at Doncaster Grammar School and St. John's College, Cambridge, where he graduated in mechanical science in 1944. On leaving the University he joined the Armaments Design Department of the Ministry of Supply and was engaged on the design of solid-fuel rockets. Eighteen months later he joined the English Electric Co. as a graduate apprentice, spending six months with the Atlas Diesel Co., in Sweden, on an apprentice exchange scheme. He was appointed a traction engineer in 1948. Mr Morton joined the GEC in 1958 as manager of the Traction Division. Mr Gracie, who has been general manager of the Witton Works for the past 20 years, has also played a prominent part in Birmingham's educational affairs, particularly on the technical side, and also holds a number of appointments on various bodies concerned with industry and commerce generally. With GEC he started at the Osram Lamp Works and later transferred to the MO Valve Co., where he introduced quantity production methods. From 1931 to 1937 he was with a firm of industrial consultants, but returned to GEC to become general manager and a director of Coldair Ltd. A year later he was appointed commercial manager of Witton Engineering Works and, in 1940, became general manager.

Mr W. Fraser, chairman and managing director of Scottish Cables Ltd., will go to Nigeria next month as a delegate to an industrial development conference. The 17-strong British delegation will tour Nigeria before attending the conference in Lagos.

Belling and Lee Ltd. announce the appointment of Mr B. M. Lee as manager of their industrial group, reporting to the company's general manager, and to the board of executive directors. This is a further step in the divisionalisation of the company into separate industrial and domestic groups, in a programme of controlled expansion which began with the reorganisation of the sales department earlier in the year. He will be responsible for co-ordinating the production, publicity and sales of the industrial group. Mr Lee, who is the son of Mr

E. M. Lee, B.Sc., M.I.E.E., director and general manager, and one of the original founders, has spent a number of years in different departments of the company and in other companies in the industry.

Sir Harold Bishop, C.B.E., M.I.E.E., director of engineering, BBC, has been elected president of the Television Society in succession to the late Sir George Barnes, M.A., D.C.L., Sir Harold will hold the office for a two-year period.

General sales manager of the company, Mr William A. Devon has been appointed to the board of Venner Ltd. from 1 Jan., 1961.

Mr J. Maxwell has been appointed factory manager of the Remington electric shaver factory at Thornliebank industrial estate, Glasgow.

Mr D. Wright has been appointed chairman of H. J. Baldwin and Co., in place of Mr H. J. D. L. Walsley who has resigned the position. Mr Wright is joint managing director of the parent concern, Hartley Baird Ltd.

For health reasons, Mr J. H. Russell is relinquishing his position as managing director of Hall and Pickles Ltd. on 1 Jan., 1961, but he will retain his seat on the board and also on the boards of Hall Engineering (Holdings) Ltd. and the Improved Metal Label Co. Ltd. Mr F. R. Robbins and Mr A. M. C. Murphy are to become joint managing directors, and Mr E. W. B. Davis will be general sales director.

Mr T. D. Gregory is appointed manager of the English Electric Co.'s Calcutta office. He has been export area manager for North America in the company's London offices for the last year, following five years as deputy manager, Contracts and Administration, in New York. Mr B. P. Rivett, who has been the company's west coast technical representative in the United States for the last five years, succeeds Mr Gregory as export area manager, North America, in London. Mr Gregory joined the company as a student apprentice in 1935. He was appointed a sales engineer on heavy plant at Stafford and with the London office. In 1945 he took over as manager in the Eastern Electricity Board area at Ipswich, where he remained until he joined the English Electric Export and Trading Co. Ltd. in New York. He served as deputy manager, Contracts and Administration, in the US operation until 1959. Mr Rivett joined the EE Co. as sales engineer for electrical plant at the Stafford works in 1951, where he remained for three years. From 1955-60,

Mr Rivett was the company's technical representative for the west coast territory of the United States. In this capacity he was closely concerned with many of the important contracts for heavy plant awarded to the company.

Col C. E. Mackellar, director of Westool Ltd., and Mr J. B. Bailey, chief applications engineer of the company, are now on a visit to Russia to discuss modern techniques in coil winding and the application of various control equipment to Russian industry. They will also explore the possibilities for the export to Russia of coil-winding machines, electric clutches and brakes and air-conditioning equipment.

We hear from the London Electricity Board that Mr W. A. F. Howard, M.I.E.E., A.M.B.I.M., has been transferred from the position of district engineer of the Central District to a similar post with the Northern District (*ESH, page 78). This follows the appointment of Mr J. P. Tanner, A.M.I.E.E., as manager of the Board's North Western District. Mr Howard was sub-area construction engineer for the Board's northern sub-area from vesting day until May, 1957, when with the reorganisation of the Board's area he became district engineer, Central District.

Two sales representatives of Edmundsons Electrical Wholesalers Ltd. have just completed 50 years' service. They are: Mr C. F. Hutley and Mr S. E. Snell. Mr Hutley is well known to the electrical fraternity in the City and West End, while Mr Snell, who retires on 31 Dec., has concentrated on the East London postal area in recent years. Presentations are to be made to them both next week.

Mr E. H. N. Breeze has been appointed commercial manager of Lucas Industrial Equipment, a member of the Lucas group of companies.

Previously personnel manager with Rolls-Royce Ltd., Mr D. H. Atkinson has been appointed to a similar post for the Ilford region of the Plessey Co. Ltd.

Appointed to the position of director of the International Atomic Energy Agency's Division of Scientific and Technical Information is Dr Bernhard Goss who has served with the IAEA since November, 1958, and from 1949 to 1950 was with the Electrical Research Association on a British Council fellowship.

Mr A. A. Young has joined B and R Relays Ltd. as sales engineer for Scotland and Northern Ireland. He was previously an electrical engineer at the BP Refinery at Grangemouth.

Sir Willis Jackson, D.Sc., F.R.S., has accepted the invitation to become president of the Association of Supervising Electrical Engineers, and will succeed Sir Josiah Eccles, C.B.E., on 1 Jan. next. It will be recalled that Lord Verulam was to have become president but died on 18 Oct.—the day before Sir Josiah retired from office, and the latter subsequently agreed to continue as acting president until a successor was appointed. Sir Willis Jackson, who will be installed as



At the opening of Atlas Lighting's Glasgow showroom (referred to on page 940), left to right: Mr G. Gibson, Mr A. S. Shier, Dr H. H. Ballin, Mr J. W. Moule (chief comm. officer, S. Scotland EB), and Mr G. S. Bowman (North of Scotland HE Board)

at the meeting of the IEE on s director of research and educa-Associated Electrical Industries ster) Ltd., a position which he inquisish next Oct. to return to erial College of Science and gy—to the chair of Electrical ing there. He resigned from his the College in 1953 to become of research and education with litan Vickers (now AEI). Sir also the immediate past-presi-the IEE.

ish Eccles, O.B.E., deputy chair-he Electricity Council, has been y the British Productivity Coun-director of National Industrial ciency Service.

C. Miller has been appointed chairman of Earle Bourne and bsidiary of Delta Metal Co.

A. Tatford, director of contracts UK Atomic Energy Authority elected president of the Institute Supplies for a second year. He been appointed a director of the Institute of Governmental g Inc., of US.

. Foxwell, managing director,

and **Mr G. Ball**, general sales manager of Wayne Kerr Laboratories, are now on a business visit to the USA.

OBITUARY

Mr M. J. Dark, A.M.I.E.E., formerly London director of Taylor Tunnicliff and Co. Ltd., died on 8 Dec., aged 80. He retired from that company three years ago, after 45 years as London director. He started his career with Edison Swan Electric Co. as a draughtsman, then joined British Westinghouse Co. at Traf-ford Pk, and from 1902 to 1908 was in charge of Johnson and Phillips' Switchgear Department. After five years with Electric and Ordnance Accessories Co. Ltd., in Birmingham, he joined Taylor Tunnicliff and Co. and took charge of the London office. Subse-quently he was also a director of Elec-tric Transmission Ltd. and Taylor Tunni-cliff (Refractories) Ltd.

Mr A. Bolton, director and former sec-retary of Erskine, Heap and Co. Ltd., died on 4 Dec., aged 79. He was with GEC from 1895 and joined Erskine, Heap and Co. in 1907 as assistant sec-retary, being appointed secretary in 1918,

a post he held until retiring in April, 1959. He had been a director since 1949.

Mr O. H. Layhe, O.B.E., metals con-troller to the BICC group until retiring last March, died on 2 Dec., aged 65. Mr Layhe joined the former BI Co. at Prescott in 1909, going in 1925 to the Newcastle sales branch office. In 1943 he returned to Prescott as assistant home sales manager and became assistant com-mercial manager in 1947. The following year he was transferred to London as manager (purchasing). In recognition of his services to the joint committee of the cable making industry, Mr Layhe was awarded the O.B.E. in 1956. The follow-ing year he became metals controller, and was appointed director and general manager of British Copper Refiners Ltd. He was also a director of several sub-sidiary companies in the BICC group.

Mr L. Jessop, A.M.I.E.E., who was formerly in business in Bradford as an electrical engineer, died on 2 Dec. on board the liner *Oriana*.

Mr J. Carson, O.B.E., managing director in charge of tube production for Stewarts and Lloyds Ltd. since 1948, died on 9 Dec., aged 69.

Visual problems on motorways

of the highlights of this year's E conference was the paper by Waldram on a driver's reaction to sees when on the road both by day and by night. This masterly survey object, taken both from personal e and study of the reaction of as all the more refreshing in gh the work of one intimately l with road lighting problems ng period, it did not approach lem from a purely objective ing viewpoint. As Mr Waldram often said, lighting does not bring about either safety or 1; its contribution is to give to t night the information which d in order to drive both fast ly.

study is, of course, never com- l Mr Waldram took his argu- stage further in a paper read e Illuminating Engineers' Society n last Tuesday when he dealt problem as it particularly con- ne modern high-speed motor-

Day Driving

impression of driving on a by day is that it is easier than n traffic routes. Despite the eeds, the driver has less to do, as to be more alert and re- his estimates of stopping dis- compensate for the higher he danger lies not so much in traffic moving with him, clos- of which are slow in that they, travelling at high speed, as in mary vehicle or dropped ob- which, relatively speaking, as at 70 m.p.h. to 80 m.p.h. and

will, in effect, plough through the cloud of oncoming vehicles like a car crashing through a car park at 70 m.p.h. Added to this is the danger of unexpected move- ments it will impart on other vehicles.

The greater clearances he must allow for by day means that he must fixate his vision 1,000 ft or more ahead with only casual observance of mid-distance conditions, a change of which could equally well create unexpected hazard and have to be compensated for. This, and the lower manoeuvrability at speed, means that though motorway driving is boring, the temptation to relax or even to sleep must be resisted by every means. By night on unlighted roads, the soporific effect of streams of red rear lights mean- dering from side to side creates an addi- tional danger; moreover, they do not by their movement or relative position give any reliable perspective impression of distance.

Night-driving by headlights, even when conditions allow them to be used un- dipped and dazzle-screens mask the glare of oncoming traffic in the adjacent lane, still only gives him a visual range of 300 ft to 400 ft, part of which may be reflections from central studs. Beyond this, he must drive by red lights, the changing pattern of which he is unable to interpret with any degree of accuracy. He cannot reliably discriminate be- tween the rear light of a car and a red light of an obstruction until too late to take safe avoiding action. Other menaces which he has to contend with is the patch of fog, which may mask one or more stationary or slowing vehicles, the obscured windscreen by mud thrown up from an overtaking car, which may take

10 sec to 15 sec to clear, and the inade- quate view of rear traffic through small mirrors partially obscured by dirt, con- densation, etc.

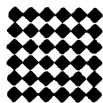
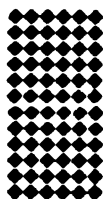
Megacandle Headlights

Vehicle headlights by themselves will never give the required range for fast night driving. The frame of reference for locating traffic on a clear night 1,000 ft ahead would necessitate headlight inten- sities of the order of megacandles, in- tolerable to other road users, even if they could be realised on the vehicle.

It is part of Mr Waldram's contention that fixed lighting on a motorway will reveal to a driver all that information which is available to him by day, no more or no less. Taking as his example the Autoroute du Sud, near Paris, he states that, despite the hazard of columns on the roadside and particularly in the centre reservation, the distance to which objects can be seen is not limited within the range imposed by topographical features, road perspective is recognisable and accidents or stationary objects can be recognised in time. The lighting also gives good warning of fog patches.

Laying down 11 basic requirements for good motorway lighting, he visualises lanterns with distribution cut-off which is not too hard, providing a little light up to the horizontal and fairly narrow in azimuth, mounted high in a single row for each carriageway at spacing- height ratio depending on the running surface but probably not exceeding 3.5.

Mr Waldram concludes his paper with some criticisms of signal lights on vehicles and recommendations for their improvement.



Imporous graphite producti

OUTSIZE CARBONISING AND GRAPHITISING FURNACES

GRAPHITE, one of the many forms of carbon, occurs naturally as "plumbago" but it can also be synthesised from amorphous carbon, usually in the form of lampblack, by graphitising; that is, heating to a temperature of around 2,500°C in an inert atmosphere. In some cases the products are formed into the required shape in a plastics mix of amorphous carbon with a binder and graphitised by the passage of current through them from electrodes connected to a high-current, low-voltage transformer; in other cases they are heated in a furnace in which the walls and heating elements are of graphite to prevent contamination by other metallic impurities or oxides. Graphite so formed varies considerably in particle size and porosity.

Research workers, among whom the most famous was Dr Acheson, have spent considerable time and effort in improving both production processes and physical properties of synthesised graphite. At the same time, the fields of application have expanded from its first uses as pencil leads to lubricants, seals and glands for chemical plants, high-temperature bearings and bushes, nozzle throats for jet engines and rockets and also in the construction of nuclear reactors, for which it has proved a suitable moderator material. More recently, the application in this field has extended to graphite fuel element cans in proposed high temperature types of gas-cooled reactors such as are currently being designed in Britain, Germany and the USA.

An essential requirement is near-impermeability to gases or fluids at high temperatures. Among the methods which have been developed is the furfuryl alcohol process, originally an RAE process, which was taken up by the UKAEA at Harwell and finally developed to the present stage by the Hawker-Siddeley Nuclear Power Co. at Langley. Very briefly, the process involves the impregnation of a finished graphitic element with a low surface tension hydrocarbon and converting the latter into carbon or graphite while in the pores in a baking or graphitising furnace. The resultant product will maintain a vacuum of better than 0.01 mm mercury for several hours at 1,800°C under inert gas conditions. Another important result is that the ultimate tensile strength increases from 3,200 lb/sq in. to 5,900 lb/sq in. with corresponding improvements in flexural strength and elastic modulus.

Process Plant

The experimental furnaces on which the development was carried out are, of course, too small for full-scale production of elements used in reactors. Eighteen months ago, Hawker-Siddeley decided to order four carbonising and two graphitising furnaces for their factory at Langley, near Slough, the former to have a charge capacity 4 ft 6 in. dia by 14 ft 6 in. long and a controlled atmosphere of 1,000°C while the latter, four times larger than any yet designed, would operate at up to 3,000°C or 1,700°C at a vacuum of 0.1 mm mercury. The design was placed with Spemby Ltd., of Chatham.

The Carbonising Furnace

The carbonising furnace comprises a vertical cylinder 22 ft high by 8 ft 6 in. dia and is charged vertically through the top by means of a 3-ton gantry. The charge is contained in a muffle chamber externally heated by three chrome tape elements arranged in three zones individually controlled. A fan draws hot gases through the charge and upwards through re-circulation ducts in the walls of the chamber. Thermocouples at selected points monitor the temperature, which is recorded on instruments at the control platform where fine temperature regulation is automatically maintained by a pyrometer. The atmosphere is inert, comprising nitrogen with an oxygen content of not more than 10 p.p.m.

The load on the furnace is 50 kVA max supplied by a tapped transformer on the 440 V three-phase system having secondary tappings from 33 V to 213 V.

The Graphitising Furnace

The graphitising furnace was designed to a requirement calling for a unit capable of accommodating a charge up to 10 ft long and capable of attaining a temperature of 3,000°C with an 800 kVA power load. This, at a top-entry furnace and comprises a pressure vessel lined with graphite and with graphite heating elements.

The graphite lining of the furnace comprises an assembly of petal carbon plates in two separated overlapping and bolted together with graphite bolts. The wall linings comprise graphite rods circumferentially distributed with diametrical slots to take close-fitting graphite plates to form a cylindrical assembly, the joints self-interlocking to avoid the necessity of complex thermal components. A continuous ring of L-shaped blocks at the top of the lining provides a stepped assembly for supports and provides a seal with two independent sections designed to reduce convection and radiation losses over a wide range of temperatures and long length of the lining components introduced expansion problems which complicated the sealing, but these were solved by careful design.

The heating elements are axially spaced graphite rods placed circumferentially around the heating space. The ends of the rods are threaded and provided with ceramic seatings to ensure good electrical contact with the graphite ring which forms the neutral connection. They are, of course, connected in star. Power is supplied to the elements at 25 V from a special tap-changing transformer of special design and manufacture on the 6.6 kV system fed into a furnace transformer in the same tank. An 18-step coarse and 18-step fine tap-changer between them of 143 steps of 0.14 V to be selected, the actual selection being made by a motorised controller under the influence of the automatic temperature regulator with indicating and recording facilities. The control signal is derived from a total radiation pyrometer. Protective circuits include overcurrent, power failure, maximum temperature trips and interlocks for cooling water and gas supplies.

Transformers in court

1959 PROFIT ON EXPORT OF LARGE TRANSFORMERS 2.4%.

AGREEMENT STOPS HOME PRICES FALLING TO EXPORT LEVELS

CTIONS about discussions to extend membership the Transformer Manufacturers' Association continued to play a big part in the Restrictive case last week. As we reported in the last issue, Kevan, of the English Electric Company's transferring department, had spoken of negotiations between individual members of the TMA and manufacturers outside the Association. Counsel registrar of Restrictive Practices had suggested object of the conversations was to drive smaller firms out of business.

Mr Dyson was succeeded as a witness by Mr J. Dyson, regional manager, transformer division, AEI. He said firms who were not members of the Association always tried to charge prices as closely as possible with TMA prices as possible. Sometimes they charged more, sometimes less. In connection with the case in Leeds in June, there was disagreement about it also about the sharing of business. Outside firms disliked the Association rebate scheme; they thought it should be scrapped.

Mr Dyson denied that any attempt was made to prevent entry of outside manufacturers and to discourage competition to the industry. He denied that there was any intention to destroy the capacity of smaller firms who were members of the Association.

Mr Dyson said he thought meetings of representatives of firms to discuss export business were helpful, but they should not be prepared to enter into such discussions with competitors at home if there were no home sales.

Mr Dyson said firm stability was not necessary only in order to enable the transformer industry to remain in business; it was necessary because the industry was to keep the confidence of its customers. Without the long-term stability which the TMA agreement gave the industry, manufacturers would not be able to attract people to work for them. Therefore, it was only by having a stable home market that they were able to keep capacity for the variable

quantity of export business which it was in the country's interest to take. Engineering and manufacturing knowledge was the same whether the transformer was being built for the home market or for the export market.

Mr Dyson was asked by the President of the Court, Mr Justice Russell, whether he thought it would be a good thing if the smaller manufacturers were driven out of business. He said he did not. They had an important function to fulfil in the industry within a limited range. Their diversification helped to keep down costs. He also said that while winners of large orders were proud to announce their success, those who received small orders were not so keen on other companies knowing.

Profit on large transformers exported during 1959 was only 2.4%, he said later. If the TMA agreement were ended, any intensification of competition might force down export prices and remove that small margin.

Accountants and Economists

A sidelight on the difficulty of operating the agreement was cast by Mr W. E. Carnelley, an accountant who dealt with adoption of a common form of preparation and presentation of costs by TMA members in arriving at the prices. He said it was difficult to convince engineers, who had been used to slide rules and making estimates, of the need to discuss costs with accountants; and it was equally difficult to discuss with accountants what was the best method of estimating overheads in costs. He agreed with counsel that figures before the Court showed that the most profitable and consistent section of business in the home trade was in large transformers. There had been a decline in profitability in all sizes of transformers in both home and export trades since 1955.

An economist from Oxford University, Mr G. B. Richardson, told the Court that export prices for large transformers had been falling and that without the TMA agreement home prices would have tended to fall to the same level. He said excess production in some years was the price transformer manufacturers had to pay for meeting the peak demands. Features of the industry were fluctuating demands, substantial fixed overhead costs and the fact that transformers were for the most part made to order, not for stock. Questioned about the possibility of a price notification scheme as an alternative to price fixing, he said it was conceivable but would inevitably be elaborate. He thought that abandonment of the present agreement would inevitably lead to greater instability in prices.

Mr Richardson told counsel for the Registrar that he could think of several industries besides transformer manufacture where fluctuations in orders occurred, but in those industries the effect was different. He said members of the TMA adhered to the price-fixing agreement "very substantially." Without the agreement, it was within the power of the electricity supply authorities to drive prices down.

After Mr Richardson had given evidence, counsel for the Registrar began his address to the Court.

The case so far . . .

The member Transformer Manufacturers' Association is appearing before the Restrictive Practices Court its case for continuing to provide minimum prices for transformers for use in the UK. In the opening statement on behalf of the Association, much was made of the need for such an agreement if there was to be a parallel basis for co-operation in the export field. The need to operate as a source of strength in bargaining with the rest of the industry was also stressed. Witnesses for the Association have drawn attention to under-employment and capacity of the industry at present and have pointed out its difficulties in selling overseas. They have described tentative negotiations by individual members with non-member firms in an attempt to extend their membership. The case began on Monday, December 12, and is expected to continue for some time.

equipment for industry

Unusual potentiometric recorder

CONVENTIONAL potentiometric methods for measuring voltages, while extremely accurate in principle, suffer from the inherent possibility of error due to slide-wire wear. The principle is retained in a recently introduced instrument for continuous chart recording of d.c. voltage outputs, but with the elimination of the traditional slide-wire. Instead, a fixed resistor is used, across which the voltage to be measured is connected, the necessary balance voltage being obtained by passing a variable current through the resistor. Key to the method is the use of a force-balance transducer, an electro-mechanical device by which current can be varied. This is connected in series with the fixed resistor and a stabilised voltage d.c. supply. During measurement, out-of-balance voltage signals, suitably converted and amplified, are fed to a servo-motor. This drives the force-balance transducer clockwise or anti-clockwise through a given angular rotation until null-point balance is achieved. The servo-motor also drives the chart printing head which thus registers on the chart the appropriate balance voltage. One version of the instrument available, using a 10½ in. wide chart, has provision for 12 input channels. These are cyclically switched at five-second intervals, giving one reading every minute for each channel. There are six chart speeds, allowing a minimum of one week and a maximum of four weeks recording time for the standard chart length. The instrument has a variable input range with a minimum of 0 to 1 mV and is suitable for recording outputs from thermocouples, strain-gauges and other transducers. *Smiths Industrial Division, Kelvin Hse, Wembley Park Drive, Wembley, Middx.*

Vapour cooling valves

NORMAL methods of cooling industrial thermionic valves, either by air-blast or water circulation, are not always suitable. Examples are in polluted atmosphere conditions and where there is a limited supply of cooling water. An alternative method, which has been applied to cooling oscillator triodes of an induction heater, makes use of latent heat of absorption due to vaporisation. In essence, the cooling unit consists of a jacket, filled with distilled water, surrounding the valve anode cap and integral with a condenser. Anode dissipation boils the water at atmospheric pressure, the steam being condensed and the condensate returned to the jacket in a continuous cycle. The anode temperature is thus maintained at 100°C. *English Electric Valve Co. Ltd., Chelmsford, Essex.*

Liquid level controller

A LEVEL controller for conducting liquids, the "Resistron," makes use of the liquid to complete the circuit of a single-valve amplifier which, in turn, actuates a control relay integral with the unit. This is done by means of electrodes fixed at the high and low levels, there being different types available for various liquids, including acids. The relay incorporates one normally open and one normally closed pair of contacts, rated at 5 A, 250 V. These can operate a visual or audible alarm or appropriate control circuit. The device is suitable for liquids having a specific resistance of not more than 50 kilohms/cm. cube and can be applied to boiler level control and indication. Supplied with sheet-steel or cast-iron case complete with green and red warning lights, the

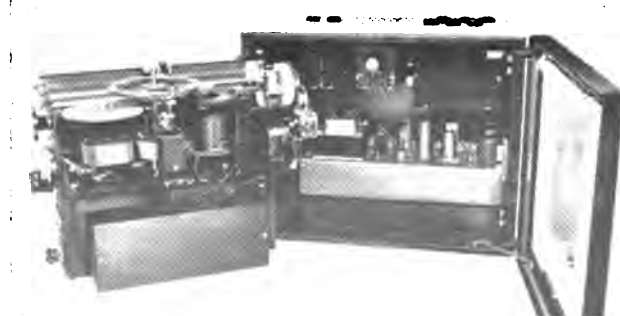
unit has dimensions 4½ in. by 4½ in. It is available for 110 V, and 440 V supplies at 40-60 c/s. *Industrial Automation Ltd., Station Altrincham, Cheshire.*

Silicone fluids price cut

PPRICE reductions have been announced for "Amersil Electro" a phenyl-methyl silicone protective. Its purpose is to prevent track electrical equipment such as high voltage switchgear from becoming in contact. This it is claimed to do by preventing condensation and, at the same time, sealing off components from corrosion. The fluid is low viscosity, has a low surface tension together with a freezing point of -58°F and a boiling point of 575°F. Available in a aerosol spray container, new 120s/container bought singly or in a container in 12 dozen lots. Also in price is "Amersil Formula" pure methyl silicone, whose purpose of application is that of an anti-stick for releasing die-casting moulds. *Oils Ltd., 11a Albemarle St, W.*

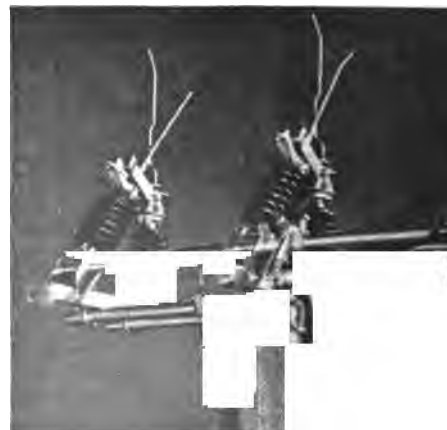
11 kV o/h line isolator

UNIQUE feature claimed for the 11 kV pole-mounted isolator of the rocking type is the use of a rod instead of the usual push-rod—operation. This is said to give advantages of simplicity and low cost. The insulator rod is supported parallel to the line on pedestal type bearings and freely attached operating handle. In operation, the handle is swung through right angles to the rod and rotated about the horizontal plane. The isolator can be padlocked in the open or closed position, using the handle in effect as a hasp. Another advantage of the design is the use of universal support steelwork for mounting in either horizontal or vertical positions, and for either two- or three-insulator units which are available. In addition, the design is suitable for either single-poles. The U-shaped fixed contacts are claimed to give increased life with increased current, while the moving contacts can be rotated to give uniform wear. Nominal current 400 A. Four types of insulator available. *Switchgear and Equipment Co., Southam Rd, Banbury, Oxon.*



▲ Front view opened up of Smiths potentiometric recorder. Instead of conventional slide-wire, this instrument uses a fixed resistor in conjunction with a servo-driven force-balance transducer to produce balance voltages. Drive mechanism is seen on left with servo-motor amplifier and stabilised power supplies on right

Switchgear and Equipment Ltd. 11 kV isolator. Special feature is adoption of a rotating rod to open and close the switch



for the electrical trade

ing on the skirting

SYSTEM of skirting board heating employing short, simply installed elements is available. It is based upon the "inflation" element—a resistor of silicon carbon spluttered on to sheets of bonded fibreglass. The element used in this system is completely enclosed in a plastic material and is thus insulated by it. Short sections of about 50 W/ft run in two parts, first, the rear panel houses the element and embodies attachments for fixing and interconnection; and, second, the front "sculpture" face which is screwed into place at the installation of the rear. The front panel mentioned above provides inlets on top and bottom for the passage of air. Connections are supplied primed ready for any type of paint desired. Short sections of wood having identical profiles can be supplied to fill in corners and odd spaces. These incorporate terminals to take the connecting cable. Including purchase tax, is 24s 11d/ft. *Inflation Ltd., 12 Cophall Court,*

s, scrubs and polishes

ULTI-PURPOSE floor-cleaner, "Triumph," was introduced recently. It is a commercial machine vacuuming, scrubbing, polishes and sands by the attachment of a number of accessories. It is notable for its lightness in weight, in fact, requires an extra clip-on for heavy jobs like scrubbing and sanding. Its motor of 500 W rating with belt drive has no belts, gears, pinions or gears. In addition to the clip-on attachments are oscillating wire brush, 7½ in. dia, suction impeller and scrubber. "Triumph" is guaranteed for two years and is covered by country-wide after-sales service. *Triumph (Universal) Ltd., 590 Wandsworth Rd., S.W.8.*

TRADE PUBLICATIONS

ATE.—16-page coloured brochure on sound systems—including broadcasting, music, radio, intercommunication, noise detecting and locating. *Communication Systems Ltd.*

FALKS.—Ten-page brochure "Falks Lighting Service" describing lighting systems for public buildings, stores, schools, etc. *Falks, Stadelmann and Co., 91 Farringdon Rd., E.C.1.*

HONEYWELL.—Seven-page illustrated booklet on domestic heating controls. *Honeywell Controls, Ruislip Rd East, Greenford, Middx.*

BULGIN.—News Bulletin No. 33, Volume 3, 1960. *A. F. Bulgin and Co., By-pass Rd., Barking, Essex.*

I.I.H.C.—Reprint of article on Refractory Suspended construction, presented to the joint meeting of Society of Furnace Builders and Society of Glass Technology, April, 1960, by W. S. Sinclair. "Icanite," a leaflet on special process cast iron for press tools hardenable by standard methods. *The Incandescent Heat Co., Smethwick, Birmingham.*

HARVEY.—Brochure entitled "The Harvey Team," describing activities, products and personnel, 1960. *G. A. Harvey and Co. (London) Ltd., Woolwich Rd, S.E.7.*

DU PONT.—Technical information bulletin on Elastomers—neoprene, "Hypalon" and "Viton," their properties and applications. No. 16, 1960. *E. I. Du Pont de Nemours and Co. (Inc.), 76 Jermyn St, S.W.1.*

C.M.C.—Folder describing diffusing panels of various shapes for use with fluorescent tube lighting, entitled "Lighting Bricks." *C. M. Churchouse, Clarendon Wks, Clarendon Cross, W.11.*

P.C.—Four-page leaflet, LT2 on industrial lighting trunking and power tap system. Also price list, for Sept., 1959. *The Power Centre Co., Wednesbury, Staffs.*

ALMA.—Reprint of four-page article entitled "Precision Wirewound Resistors, Their Design and Manufacture," by D. C. F. Bartlett, B.Sc.(ENG.), from *Radio and Electronic Components*, May, 1960. Also list of extensions of ranges and improvements in tolerances of resistors by *Alma Components Ltd., 551 Holloway Rd, Holloway, N.19.*

REIGATE.—Latest issue of *Domestic Appliance Catalogue* by the electrical and radio wholesalers *Reigate Electrical Co. (Wholesale), 61 London Rd, Reigate.*

COLUMBUS.—Leaflet and price list of automatic time-lag switches from Denmark. *Elkay Electrical, 42 Woburn Pl, W.C.1.*

Transatlantic blender

A SERIES of American domestic mixer and blender appliances is to be imported into this country and the first, a blender, will appear early next year. This blender, to be marketed under the "Waring" trade mark, comprises a circular metal stand, housing the motor unit and a tall, lidded "Pyrex" container which fits on to this. Rotating blender blades are built into the bottom of the container by means of a leak-proof bearing. When the container is placed on the stand a chuck on its underside engages a drive stud. The blender is used primarily for reducing vegetables to purée or fragments to produce sauces, though it will perform a host of other odd jobs like grinding meat, mixing batter and shaking cocktails. A special attachment converts it into an ice crusher.

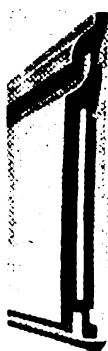
The self-lubricating motor has two speeds controlled by a switch in the base. Its housing is white, green, yellow, pink and turquoise plastics, or die-cast in chrome finished steel, copper or brass. Single-speed model is expected to sell at £15 9s 9d tax paid, the double-speed at £17. *Winston Electronics Ltd., Waring Products Div., Shepperton, Middx.*

Drying panel price cut

THE 600 W "Inferation" clothes drying heater has been reduced in price. This dryer comprises four hinged panels, each incorporating a separate element, which fold into a slim wall-mounted panel. It has been reduced from £24 5s to £19 19s, tax paid. *Inferation Ltd., 12 Cophall Court, E.C.2.*

New extractor fan

NEW in the domestic extractor fan field is the Minex Mark III "Super." Careful design of the four-bladed impeller, allows normal extraction rate of 20,000 cu ft of air/hr to be carried out at slower rotation speed and consequently, it is claimed, with less noise. Other features of the new fan are a transparent adjustable outer shutter and moulded rubber gasket for window fitting, which simplifies installation. Motor characteristics are such, it is claimed, that even when the external louvre is completely closed, the unit cannot overheat. It sells at £6 19s 6d. A reversible model is available at extra cost. *Jones and Stevens, P.O. Box 35, Eastern By-pass, Littlemore, Oxford.*



◀ A cross-section of an inflation skirting heater, showing plastic-based spluttered element with front face fixed in position. Larger picture shows complete installation

Minex "Super" extractor fan. It has four blades, and is claimed to achieve normal extraction at a slower speed. £6 19s 6d ▶



SILICONES IN ENGINEERING

APPPLICATIONS of silicones in engineering are discussed in a paper by Mr C. A. Grinham, B.Sc.TECH., A.M.C.T., (Midland Silicones) presented to the Manchester Association of Engineers last week. He opens his paper by observing that since silicones became available in commercial quantities only ten years ago, they have achieved over 400 known applications in over 20 separate industries.

Silicones may be split into three categories when their applications in industry are under discussion: silicone fluids, silicone resins and silicone rubbers. Fluids are of two types, chemically distinguished as dimethyl fluids and methyl-phenyl fluids. In general, the latter possess better oxidation stability, better lubrication properties and, in certain cases, lower freezing points.

Fluids

The fluids have excellent viscosity/temperature characteristics, inertness and low temperature properties, which make them particularly suitable for use in damping devices, their application to dashpots in electrical switchgear being

an offshoot of this. The dielectric properties, combined with the inertness, heat stability and low volatility, make them suitable impregnants for metal foil capacitors, and appropriate for use as transformer coolants. On the mechanical side, the impressive temperature range of -40°C to 200°C is quoted for a lubricating grease formed from a medium phenyl content silicone fluid which is filled with lithium soap.

Resins

Silicone resins find direct application in electrical equipment, particularly where high temperatures are to be withstood. The paper makes the point that the good temperature characteristics may be used either to permit normal life at elevated temperature or to give enhanced reliability where ambient temperatures are not unusually high. Again, ability to operate at high temperature with normal life may be used to permit weight-saving through construction of more compact electrical machines.

Finally in the list, silicone rubbers have obvious electrical applications. In

the form of sleeving, they are to replace organic rubber or p.v.c. where temperatures are high, miniaturisation causes difficulties with p.v.c. in soldering operations, and tropical ageing causes deterioration of the p.v.c. or organic rubber.

Silicone rubber insulated cable for both high and low—as in air temperature applications. Since silicone rubber burns to silica, it can withstand a fire with some retention of insulating properties.

Cold-curing rubber

A recent development in rubbers concerns cold-curing rubbers. These are fluid or semi-fluid which on addition of 1% to 4% cure to rubber-like solids at room temperature in a matter of 30 minutes. Although they possess the temperature resistance of silicones, they are not so strong mechanically. Their uses include application as potting materials in which epoxy resins are cast and the potting and pre-potting of electronic components.

s.s. Oriana

MORE ELECTRICAL DETAILS

MORE information on the electrical equipment on the s.s. *Oriana*, the maiden voyage of which was reported last week (page 890) is now to hand.

Messrs Laurence Scott and Electromotors are among the manufacturers supplying the electric motors, generators and control gear. Their contribution includes the three 300 h.p./200 kW motor-alternators for the fluorescent lighting installation, 10 h.p. and 20 h.p. boat-davit motors and the steering gear motors. The latter are two of 120 h.p. and one of 55 h.p.

The a.c. circuits are supplied at 230 V, three-phase 50 c/s and all motors are of the drip-proof enclosed ventilated type.

For the lighting of the *Oriana*, some 14,000 fittings, including nearly 100



GEC hot
fluorescent
in the M

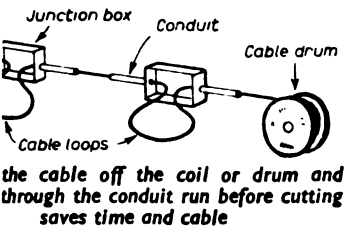
The fluorescent
lighting is on a.c.
circuits fed from
these 200 kW alterna



special designs, have been supplied to the GEC in addition to the hot and cold-cathode fluorescent fittings in the major public rooms. GEC is also responsible for the design of the internal telephone system, alarms and room switches, push buttons, etc. Among the special lighting is the illumination of the John Piper mural in the Princess Room.

Concealed GEC cold cathode fluorescent lighting has been chosen for the illumination of the John Piper mural in the Princess Room.

PROBLEMS AND PRACTICE

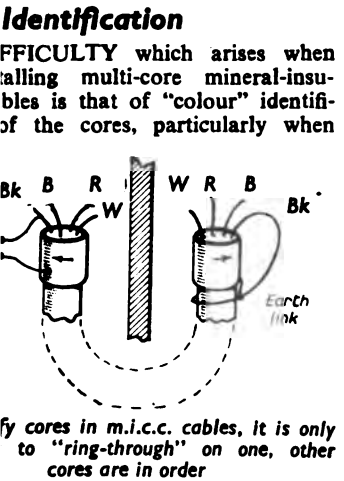


g off the Coil

ENT increases in electricians' ages emphasises more than ever need to conserve labour and costs. A frequent source of waste on with v.r.i. or p.v.c. cables in conduits comes from the practice of measuring the length to the cable reel with a little added "for luck" cutting off. When all is installed, waste in cutting ends plus the nominal length which, somehow, was right, is considerable.

Measuring from the coil saves a lot of measuring time and cuts waste to a minimum. The coils are fed on a rod and enough pulled through the conduit run to the farthest end. Loops are then made at the intervening cable boxes and junctions made at each station working from the far end. Excess cable is pulled towards the coil and rewound when junction is complete.

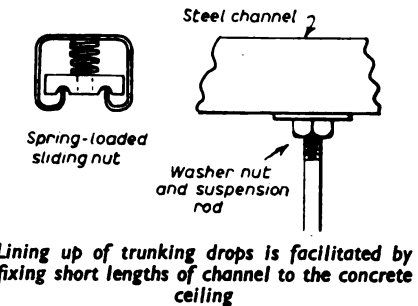
This method has the additional merit of ensuring that the cables enter the conduit from twists, and two or more can be inserted and run together separate coils on the same support.—M. Neidle.



the ends of a run are distant from each other. It is usually done by earthing each core in turn and ringing through or using a megger. A method I use is to first make off one end complete and identify the cores by whatever colours are being used. For example, in a four-core cable they would be identified as black, red, white and blue, in a clockwise direction. Before leaving this end, I earth the black core and leave the others clear. The far end is now sealed off and either megger tested or rung through to find the earthed core, this, of course, being labelled black. It is now a simple matter to label the remaining cores in order in an anti-clockwise direction to give red, white and blue. This method can be used regardless of the number of cores since they must maintain their relative positions throughout the cable run.—M. McGee.

Lining up Trunking

NO matter how carefully the chalk string is used to lay out trunking suspended from a concrete ceiling, variations always creep in, if only through pebbles in the concrete, in the positioning

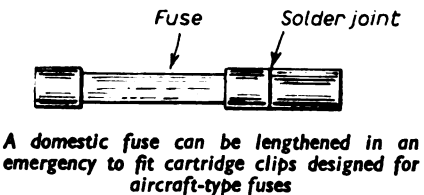


of suspension rod fixings. By using short lengths of steel channel, such as are used for cable racks, secured to the ceiling at right-angles to the run of trunking, together with the appropriate spring-loaded nut in the channel, carrying the threaded suspension rod and locknut, it is an easy matter to line-up the trunking after erection. The height of the trunking can also be easily adjusted if a suspension stirrup and threaded rod are used.—F.S.

Temporary Fuse

SOME specialised equipment uses aircraft-type cartridge fuses, replacements of which may not always be immediately available. Fuses to BS 1362, as used on ring circuits, are of the correct

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

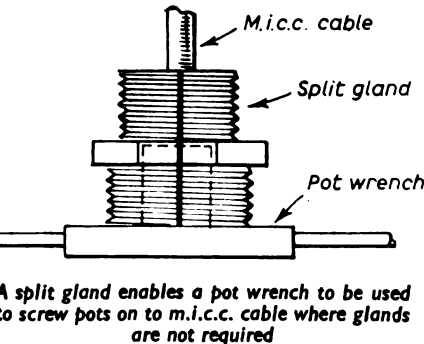


diameter and rating but are too short. In such an emergency, I cut a short length of $\frac{1}{4}$ in. brazing rod square at one end and tinned the end surface. The end of a fuse was also carefully tinned with soft solder, taking care not to overheat it. With the short rod held vertically in a vice and heated until the solder melted, the flame was taken away and the fuse end applied to the rod and held in position until the solder solidified. The residual heat in the rod was sufficient for the purpose. Afterwards the rod was cut to length to suit the holder.

It may be as well to mention that the rating of the fuse is not necessarily suitable for a d.c. supply unless it is at a low voltage.—Ubique.

Pot-wrench Tip

USERS of m.i.c.c. cable will be familiar with the comparatively recently introduced pot wrench and will have found it a great advantage over the former practice of screwing the pot on to the cable with pliers. Used in its intended manner, however, a gland is always employed but there are, of course, many situations where a gland is not required. To meet these cases it is an advantage to have a gland body which has been split in half from top to bottom. Using this in association with the wrench, the pot can be applied to the cable after which the split gland body can be removed for further use as and when necessary.—J.S.B.



News of the Week

CONSENT SOUGHT FOR WYLFA

Nuclear station, possible of 800 MW, by 1967 proposed

CONSENT for a nuclear power station of a capacity not exceeding 800 MW is being sought by the CEBG. The Board is applying to the Minister of Power and the local planning authority, Anglesey County Council, with a view to having the station in commission in 1967. The selection of the Wylfa site for the second nuclear power station in North Wales was announced by the CEBG last July and there has been but little opposition to the proposal. Actual site of the station is likely to be near Cemais Bay on the west side of the head.

It is planned to connect the station to the national grid at 400 kV so as to minimise the number of transmission lines required. Routes for these lines will shortly be discussed with the local planning authorities and others concerned, prior to application for consent for the lines being made to the Minister of Power. Discussions have already begun on the particular problem of where to cross the Menai Strait.

Meanwhile, Anglesey County Council officials have asked the CEBG to consider the possibility of laying a submarine cable across the Strait, and although the Board have indicated that such a scheme has serious difficulties, they are prepared to consider it.

Anglesey officials point out that sea cable power transmission will be utilised in the cross-channel cable link. The Council may press this alternative to the overhead transmission line when the

CEGB makes formal application for approval.

If consent is granted, Wylfa will be the CEBG's eighth nuclear power station. Those already under construction are Berkeley, Glos (275 MW); Bradwell, Essex (300 MW); Hinkley Point, Som (500 MW); Trawsfynydd, Merioneth (500 MW); Dungeness, Kent (550 MW) and Sizewell, Suffolk (580 MW). Consent was recently given for Oldbury-on-Severn, Glos and inquiries have been issued.

Four-day week at Hotpoint factory

IN the New Year, AEI-Hotpoint Ltd. are to introduce a four-day week for some 650 workers (about a quarter of the employees) at its main manufacturing centre at Peterborough, which is largely concerned with refrigerators. Full-time will continue at Keeley St, Birmingham, where kettles, fires, convectors and other small appliances are produced, and at Llandudno, where the "Supermatic" washing machines are made.

Although the company claims that it had a relatively small share of the large stock of refrigerators in the pipeline, its sales have been affected to a certain extent by dealers' reluctance to order while carrying large stocks of other models.

New A.E.I. - G.E.C. company to lift glass-tube output

AEI Lamp and Lighting Co. Ltd. and the General Electric Co. Ltd. are to form a company early next year to take over their glass manufacture and glass sales. This new concern will take over all the glass manufacture of the two firms (other than that covered by Glass Bulbs Ltd.) and including the AEI glass works at Chesterfield and those of GEC at Lemington-on-Tyne and Wembley.

This move is in line with past policy. Glass Bulbs Ltd. was formed jointly in 1946 to manufacture the popular sizes of bulbs on a more economical basis, with a new factory at Harworth equipped with the most modern plant. The present broad plan is to considerably increase the glass tubing facilities at Chesterfield and to further develop the Lemington factory as a special glass, hand-fabricating factory. The Chesterfield expansion includes the installation of a new furnace to raise tubing output over 50%.

PORTSMOUTH REINFORCEMENT

A NEW 275 kV transmission line between an existing substation at Fleet to a proposed new substation at Lovedean, is part of a £3 million scheme to link the Portsmouth area more closely with the supergrid system by the end of 1963. Power will be fed from the Lovedean substation to Portsmouth over two existing lines to the Wymering substation and to Fareham and Havant via new 275 kV lines. Informal discussions on the scheme have already taken place with authorities, landowners and occupiers.

Petition against "Everest" appliance firm

A PETITION for the winding-up of Merseyside Engineering (Refrigeration) Ltd. has been put forward by the West German firm Hans Liebherr, with which the company has been linked. The petition is to be heard at the Royal Court of Justice on 19 Dec.

Merseyside Engineering, who market the "Everest" range of refrigerators, washing machines and heating appliances, were linked with the West German firm under a merger through a Swiss holding company, Libholding, as we reported on 16 June. In Western Germany, Liebherrs were reported to be the fourth largest manufacturers of refrigerators. Under the arrangement, Merseyside Engineering (Refrigeration) planned to build a new factory in Caernarvonshire and, last July, Mr C. Angelis, joint managing director, stated that negotiations for the factory were proceeding, for they considered that difficulties caused by h.p. restrictions would be overcome in the near future.

The Liebherr organisation, which also manufactures cranes and building equipment, has eight factories in Germany and others in Ireland and South Africa.

LINE ERECTION FIRM APPEALS

SHOULD an overhead line erection firm be allowed to use existing buildings in open country as a stores and maintenance depot? That was the question posed at an inquiry at Castle Donington recently. Riley and Neate Ltd. were appealing against Leicestershire County Council's refusal of planning permission for the use of a group of buildings in part of the disused airfield at Gimbro Fm, Castle Donington. Giving evidence, Mr R. J. Henry, a director and secretary of the company stressed that transmission lines are, in effect, a rural industry—perhaps more of a rural industry than were broiler houses. The firm was unaware at the time of occupation of the premises that they were subject to any planning restrictions. He contended that if the amenities of the area were

affected it was by the buildings, rather than by the firm's use of them. In view of the importance of their work, of direct benefit to the agricultural community, the firm asked for sympathetic consideration and, if the Minister was unable to support the appeal in full, they suggested a limited consent for five years. Area planning officer for the County Council, Mr R. E. Tustin, maintained that the site was unsuitable for the establishment of an industrial use of the kind proposed as it was situated in pleasant open country. To permit such development even on a temporary basis would render it difficult for the planning authority to resist similar applications.

The Minister's decision is to be made known later.

thermo-electric 'fridge on the way

of the household refrigerator operating on the thermo-electric principle is nearer. With the aim of expediting its development, the General Electric Co. (who have led the experimental work so far) have entered into a joint venture with A. B. Electrolux, of Sweden, parent company of Electrolux in the UK, and in Stockholm last year a concern demonstrated a refrigerator cooler which has been developed. It is an internal volume of 1.2 cu ft and is intended mainly for camping, and for use in cars. It is battery operated and consumes 30 W. The temperature inside is 5 to 55°F below the ambient. The cold generator is made of 100 thermo-electric elements packed in thin blocks no larger than a matchbox. The unit is light, silent, has no moving parts, should last a long life.

There is still some way to go before domestic refrigerators employing the principle are evolved, the cold of Electrolux should hasten and the latter concern believe it might become an economic proposition in the not too distant future."

It is anticipated that, initially, such units will be in the 1-2 cu ft range, and their price should be lower than conventional models. GEC and Electrolux marketing designs.

The principle of thermo-electric cooling is already familiar to our readers. The system was explained in

our 26 Nov., 1959, issue—and, on 10 Nov. last, the first of a range of the small cooling units being marketed by the GEC subsidiary, Salford Electrical Industries Ltd., intended for electronic applications, was illustrated.

Mr Wood told of Lake District hold-up

THE hold-up of the final stage of the Lake District electrification—at Borrowdale—was discussed at the recent meeting of the North Western Electricity Consultative Council when Mr Richard Wood, Minister of Power, attended. He was told that people outside the Lake District were interfering in plans to provide electricity supplies to people who lived there. The latest hold-up follows a disagreement on whether certain lines should be underground or overhead (to which we referred on 20 Oct.).

Mr Wood said he would see what could be done to hasten an inquiry into the deadlock which had halted the final stages of the scheme.

A.S.E.E. MEETINGS OPEN TO NON-MEMBERS

AS an experiment, the ASEE is throwing open its National lectures in London to non-member engineers and technicians, whether accompanied by an ASEE member or otherwise. This arrangement is made possible by a 50% increased capacity in seating accommodation at the main venue of the lectures. The next meeting is at the IEE lecture on 20 Dec. (6.30 p.m.), when Mr D. H. Powell will speak on "The Electrical Control of Heating and Air Conditioning Plant."

Volex acquire "Temco"

MAKERS and distributors of "Temco" electrical accessories, TMC-Harwell (Sales) Ltd. have been purchased from its parent company, Telephone Manufacturing Co. Ltd. (recently acquired by Pye Ltd.), by Volex Electrical Products Ltd., of Manchester. The latter concern will continue to market the well-known "Temco" range of accessories under that name, and production is being transferred to the Pendleton and Atherton factories. Correspondence concerning supplies should continue to be sent to the TMC-Harwell (Sales) London office at 37 Upper Berkeley St, W.1. It has not yet been decided whether to form a new company to carry on the business.

APPLIANCE DELIVERIES AGAIN DOWN FOR JULY-SEPTEMBER

Statistics of domestic electric output in the third quarter of 1959, below, includes for the first time comparisons with the corresponding quarter of 1958. As a result a picture is again given of the reduction of the hire-purchase system, and it will be seen that the reduction has been in respect of washing machines (77% down) with washing machines 2% down on home deliveries.

Furthermore, last year's release of pent-up demand caused import of appliances to rise from £5.1 million in 1958 to £11.9 million in 1959, with many foreign manufacturers gaining a foothold in the UK market, particularly for refrigerators, which they are now trying to hold in a market of intense competition.

Although UK export deliveries show encouraging increases it will be seen from the table that these do not have

sufficient impact on total output to enable manufacturers to combat the loss of economies of large-scale production caused by contraction of the home market. BEAMA have already urged the government to improve the hire purchase situation by adopting a 10% deposit with repayment over three years for major appliances at present subject to 20% deposit and with existing repayments over two years.

FACTURERS' DELIVERIES OF DOMESTIC ELECTRICAL APPLIANCES FOR JULY-SEPTEMBER 1960

	Home			Export			Total		
	Number 000s	Value		Number 000s	Value		Number 000s	Value	
		£000	% change on 3rd quarter 1959		£000	% change on 3rd quarter 1959		£000	% change on 3rd quarter 1959
Machines with electrical agitation:									
Hand or power wringer	68	2,469	- 63	19.3	509.1	+ 10	87	2,978	- 58
Spin dryer	91	4,740	- 7	35.6	1,152.5	+ 60	127	5,893	+ 1
Washing machines (up to 10 galls.)	47	321	- 15	0.3	2.5	- 7	47	324	- 14
Washing machines (over 10 galls.)	16	242	- 77	4.9	61.5	- 48	21	304	- 74
Washing machines (non-automatic)	3	91	- 46	2.5	57.2	+ 1171	6	148	- 14
Washing machines (automatic)	49	34	- 15	14.9	9.9	+ 52	64	44	- 4
Washing machines (semi-automatic)	490	878	+ 2	131.0	194.1	- 6	621	1,072	+ 0.3
Washing machines (other)	241	3,286	- 28	73.4	642.9	+ 63	314	3,929	- 21
Washing machines and scrubbers	5.3	76	+ 12	15.1	132.3	+ 5	20	208	+ 7
Refrigerators	144	n.a.	n.a.	25.6	n.a.	n.a.	170	n.a.	n.a.
Refrigerators below 5 kW	27	326	- 4	1.7	14.5	- 13	29	341	- 4
Refrigerators 5-12 kW	120	4,241	+ 19	4.3	114.6	+ 22	124	4,356	+ 19
Drink mixers up to 3 quarts, including hand									
Drink mixers	35	402	+ 28	21.4	244.2	+ 19	56	646	+ 24
Heaters up to 3 kW	39	119	- 23	17.9	55.1	- 6	57	174	- 19
Heaters up to 30 galls.	207	317	+ 6	4.0	7.3	+ 9	211	324	+ 6
Heaters up to 30 kW	39	419	+ 6	3.0	36.8	- 35	42	456	+ 1
Washing machines up to 3 kW	759	2,974	+ 29	23.7	78.4	+ 20	783	3,052	+ 29
Washing machines	558	1,442	+ 47	2.3	5.6	- 16	560	1,448	+ 47
Dryers	106	192	- 4	18.7	34.4	+ 99	125	226	+ 4
Washing machines	283	1,048	+ 5	114.3	213.9	- 11	397	1,262	+ 2

TARIFF RISE SOON IN EAST MIDLANDS

LATEST news of impending tariff rises comes from the East Midlands. Mr N. Marsh, chairman of EMEB, told the Consultative Council at Nottingham last week that tariffs would have to be increased by next April at the latest. Tariffs in the area had been unchanged since October, 1957, apart from adjustments for industrial and certain commercial consumers, he said. Since then costs had been rising continuously and now he doubted whether even the "final" rate, steady at 1d for seven years, could remain unaltered. The Board's costs would rise by about £2½ million in 1961-62 due to September's 5s rise in the price of a ton of coal, recent wage awards, higher interest and local authority rates, and the "almost certain" increase in the CEEB's bulk tariffs next financial year, Mr Marsh said. This would more than wipe out last year's surplus.

Particulars of 106 new schemes for reinforcing or extending mains, already approved by EMEB, were submitted to the Council at the meeting. Cost is estimated at £805,600, of which £485,200 will be spent on the reinforcement and standardisation of supplies. The Council decided that monthly reports and proposed new schemes should in future be submitted to its local committees for detailed consideration.

The Council is firmly supporting the National Inspection Council. A letter to be sent to all local authorities in the area pointing out the advantages of adequate installations in houses will contain an appeal to restrict invitations to tender for installation work to contractors on the NIC roll.

Another Floor-warming course

THE Borough Polytechnic is holding a short course of evening lectures on "Electrical Floor-warming and Heat Storage" on Wednesday evenings, commencing 18 Jan. Subjects to be covered include floor-warming systems, thermal storage block heaters, thermal storage water storage systems, and tariffs. Fee for the course is £1. Lecturer responsible for the course is Mr P. A. Rowland. He will be supported by eminent individual lecturers.

E.T.U. MEMBERS ALLEGE CONTEMPT

TWO members of the Electrical Trades Union have been granted leave to serve notice of motion of writs of attachment for alleged contempt of court against Mr Frank Haxell, the union's general secretary, Mr G. Scott, national officer, and the Union itself.

For the two members, Mr J. T. Byrne and Mr F. Chapple, it was pointed out that last May they launched an action against the union seeking a declaration that the purported election of Mr Haxell was invalid and seeking damages for conspiracy. Since then, Mr Haxell had circularised branches, telling branch secretaries and committee members that they were not entitled under any circumstances to hand over or disclose to other persons, branch records and documents which are the property of the union. For the two members it was submitted that Mr Haxell was telling secretaries they must not assist the plaintiffs in obtaining evidence for their action. It was also submitted that Mr Scott had been attempting to influence the officials and shop stewards to withhold evidence from the plaintiffs and not to support the latter's case.

Engineers' pay—next move

THERE are to be further negotiations on the claim for a wage increase in the engineering industry. At their meeting last Thursday the Confederation of Shipbuilding and Engineering Unions approved a resolution calling for a resumption of talks between the parties. This follows their rejection as "inadequate" the offer by the employers' side for increases ranging from 5s 6d to 7s 6d a week, to which we referred on 1 Dec.

OFFICIAL PUBLICATIONS

BS 1732. Domestic electric irons. Part I. 5s.

BS 3285. Methods of sampling superheated steam from steam generating units. 7s 6d.

BS 358. Method for the measurement of voltage with sphere-gaps. 6s.

British Council. Annual report, 1959-60. 2s 6d.

Chandos to speak

The Engineers' Guild will stage a conference on engineers' employment on 22 March at the Connaught Rooms, London. Lord Chandos, chairman of AEI, Mr A. R. Cooper, CEEB member for operations and personnel, and Mr D. J. Mann, director and head of personnel division of Unilever Ltd., are the principal speakers.

MALVERN ON STANDARD VOLTAGE

Eight-year job completed

THERE was a time when MEB engineers at Malvern used to follow the fire brigade as a matter of course, because the old 20 kVA transformers in street kiosks used to catch fire regularly—but that has come to an end. The eight-year job of modernising the town's distribution system has been completed. Fuses at the home of the last consumer to have

the 200 V supply converted to 240 V were changed over by the chairman of Malvern UDC last week.

Mr W. S. Lewis, chairman of MEB, presented the consumer with an electric fire and said, at a luncheon at the Abbey Hotel later, that Malvern had been one of the few places where at times they had been forced to limit new load because the system would not take the strain. Improvement at Malvern, one of the biggest problems facing the Board on its formation in 1948, had taken longer than the five years he had hoped for, but had been accomplished at the original estimated cost of £500,000. Capital invested in the Malvern distribution system when MEB took over was £122,622, about a quarter of that spent on the standardisation scheme alone. Meanwhile, Malvern consumers had paid the tariffs common to the whole area, averaging 1·45d a unit, against 4·8d for domestic consumers in Malvern in 1938.

Mr E. C. Watson, manager of MEB's Worcester and Malvern district, said the new system had involved laying 38 miles of 11 kV underground mains and providing 119 new substations, as well as a primary substation and a 66 kV line to bring supplies from Worcester.



Atlas Lighting in Glasgow

The interior of the new showroom of Atlas Lighting Ltd., recently opened at 9-15 Waverley St, Glasgow S.1

1 million supergrid reinforcement

15 kV supergrid system of the South of Scotland Electricity Board is to be extended in the Edinburgh area, from Kaimes to Dewar Pl, by means of round cables and constructing at Dewar Pl a new supply point capable of g 120 MW at 33 kV. A new distribution system from this point will be ed to feed 17 existing 33/6.6 kV ons. Fifteen new similar sub- will be constructed and the trans- capacity of five others increased. ard's 275 kV supergrid plans, ed in November, 1958, provided irclement of the industrial belt land, connecting with Edinburgh mes. The Kaimes/Wishaw and /Kincardine sections were ini- be of single circuit construction ble circuit towers, but it is now y, as part of the reinforcement to string the second circuit when s are being erected. The Kaimes/ line will be routed north of ntland Hills and the Currie/ 132 kV line dismantled. The /Kincardine line will be routed of Currie and Bathgate so as available for future loads in those s and between Falkirk and outh in order that the growing Grangemouth may at some future e transferred to the supergrid Cost of the scheme is over lion and the work will be spread : next five years.

MAINTENANCE EXHIBITION

rst national Maintenance Con- and Exhibition is to be held at Hall, Westminster, S.W.1, on 16 Nov., 1961. Apart from the on of equipment itself (space for s very limited) a conference pro- is being prepared covering ance work on a wide variety of industry.

sales boost — U.K. engineers in Russia

IE industry is not waiting for y's British Trade Fair in Moscow e the right contacts. Within a of the British Institute of Direc- orting that Russia was willing to her purchases of engineering nt and that one of the main es was getting in touch with the factory chiefs, a dozen top engineers are visiting factories oscow to the Urals and lecturing firms' products to groups of 50 ussian technicians. The organiser, Wynne, claims this is the first / organised trade and technical on to visit Russia since the war. C. MacKellar and Mr J. B. of Westool. Mr C. E. B. Cooper, i Thompson, and Mr N. Kirk- f Richardsons Westgarth, are in y.

Electronic signal interlocking

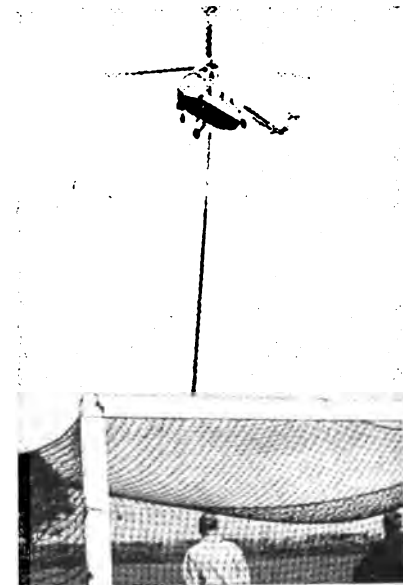
SEMICONDUCTOR electronic equip- ment is to be developed for interlocking plant in railway signalling systems in a contract awarded to Mullard Equipment Ltd. by the British Transport Commis- sion. Early next year the first equipment of this type will replace mechanical inter- locking at the Henley-on-Thames signal box. Basis of the new system is use of "logic" units for signal and point setting to give required train routing. Electronic units are of the plug-in type using Mul- lard transistors, semiconductor diodes and ferrite cores. They are designed for safe operation in ambient temperatures of between -20°C and +50°C. The units will be assembled so that they only permit connections to be made when signal and point settings are arranged to be safe in terms of train operation. The system operates with track circuits of the normal railway type.

New C.J.B. subsidiary

THE automatic control division of Con- structors John Brown Ltd. has been formed into a wholly owned subsidiary. Directors of the new company, Auto- matic Control Engineering Ltd., are Messrs I. J. Crosthwaite, D.S.O. (chair- man), H. D. Walker, R. Riley (general manager), H. H. Rosenbrock and M. P. Atkinson (chief engineer). Operations will be centred on Roxby Place, Seagrave Rd, Fulham, near the group's other works.

ROT STOPS IN REFRIGERATOR MARKET

REFRIGERATOR sales provided the bright spot in October. Stimulated by manufacturers' price cuts and aided by the mild autumn weather, they showed only a fraction of the usual seasonal decline. Only 564 fewer refrigerators were sold by area boards in October than in September, compared with a corresponding fall of 5,317 last year. Despite the imposition of hire-purchase restrictions in the meantime, October's sales were only 9.7% lower than in 1959. sales were only 9.7% lower than in the corresponding month of 1959. from the pattern of the previous month. Washing machine sales totalled 9,178 against 9,422 in September, but were not quite so far behind the corresponding level of a year ago. Washboiler sales were steady in October, compared with September, but improved on September's lag of 23.5% behind sales for the cor- responding month last year. The figures,



A 38 ft o.h. line pole being lifted into position by a helicopter during a demonstration to Mr A. N. Irens, chairman, S. Western EB, who is studying the suitability of helicopters for routine inspection of o.h. lines

Dishwashers Evaluated

SIX makes of dish-washing machines ranging in price from £89 5s to £180 14s 6d are discussed in the Decem- ber issue of *Which?*, magazine of Con- sumers' Association Ltd. The conclusion is that although the washers leave some dishes clean and sparkling overall, they give results more patchy than with hand washing. They vary in their effectiveness with different types of dishes, being in general satisfactory with plates, cups and saucers, but not good with pans or cutlery. For this category, *Which?* awards no "best buy" but considers the Westinghouse model (the dearest), the Bulpitt Swanmaid and the Colston model to perform better than the other machines tested. Difference in price for these models is reckoned to reflect their variation in performance.

Appliance sales by Area Boards	Sales in month ended 31 Oct., 1960		Sales in 12 months ended 31 Oct., 1960	
	Total	% change over corresponding period of 1959	Total	% change over previous 12 months
Cookers ...	31,320	0.0	339,910	+ 1.2
Water Heaters:				
Immersion	12,859	+10.3	189,575	- 0.5
Storage ...	5,636	+ 0.9	68,206	+14.9
Washboilers	4,981	-14.7	57,490	-17.9
Washing Machines ...	9,178	-17.4	121,592	-30.5
Refrigerators	7,560	- 9.7	140,430	-16.8
Clothes Dryers ...	6,661	-29.7	65,029	not avail.

supplied by the Electricity Council and covering all area boards in England and Wales, show clothes dryers sales for the first time.

RESTORATION AFTER FLOODS

QUICK recovery is reported from nearly all areas affected by the floods early last week. One of the new areas hit, South Wales, suffered considerable damage both to electricity supply installations and to manufacturing facilities. The Treforest Trading Estate, Glamorgan, for instance, was severely affected, total damage being estimated at nearly £6 million. Some factories were out of action for days. Simmonds Aerocessories Ltd. began limited production in mid-week, with all power resources being restored last Thursday, and many other factories were similarly affected. The transformer factory of South Wales Switchgear Ltd. was under water for a time and after several days spent on clearing up the mess, the plant was back in full production by the end of the week. Their Blackwood factory was unaffected, however.

To restore supplies in one part of its area the South Wales Electricity Board planned, erected and energised half a mile of 33 kV overhead line in 28 hr. Cables serving the Nantgarw Colliery were destroyed when the bridge over the Taff at Upper Boat was swept away, but with the new line the colliery was back on supply on the Monday night. Supplies to the Maritime Colliery and the gas works at Upper Boat were quickly restored by similar energising measures. Many of the Board's substations were flooded to depths of over 6 ft and all equipment had to be stripped from them and replaced with new equipment.

Management training

A SURVEY of management training schemes within industries of various sizes is being carried out by the British Institute of Management, and an interim report has just been published, price 17s 6d. This summarises the information so far obtained and contains the results of an investigation of the practices of over 30 undertakings.

PRIZE FOR JUVENILE "WIRING CONTRACTORS"

THE need for adequate wiring is being brought home to the younger generation at EDA's stand at the Schoolboys' Exhibition at Olympia from 27 Dec. to 7 Jan. A competition for the fastest and most judicious placing of sockets in Mum's All-electric Dreamhouse is the feature this year. Working in pairs—wireman and mate—in boiler suit and cap, the boys will race to place 38 sockets in the most convenient spots in two min. Perforated strip around the walls will enable them to plug in anywhere and, if the correct position is selected, a circuit will record their success on an indicator. The five-roomed house will be divided into three groups—hall and lounge, kitchen and bedroom and bathroom—so three pairs will be wiring at the same time. The boys, or girls, take home their plan and can invite their family to help them complete the plug layout for the rest of the house, the best entry winning a prize.

House-to-house operations in all the flooded localities were necessary to disconnect soaked installations in consumers' premises, preparatory to drying out before reconnection and, in most cases, supplies were available within 24 hr. Some installations were so badly soaked as to be dangerous, however.

In addition, in co-operation with the staff of several manufacturers of electrical appliances and members of the WVS, 12 laundry centres were set up in the worst-affected localities.

Upper Boat power station was shut down for a short time, as was that at Bath, where several substations in the low-lying parts of the town were swamped. But engineers of the South Western EB have become almost accustomed to quick remedial action this year and soon restored supplies when the floods passed. Further north, a coffer dam at the Rheidol hydro-electric scheme was swept away by a sudden rise in the river.

HOLME PIERREPONT INQUIRY

THE danger of serious smog around Nottingham if the proposed Holme Pierrepont power station was built, was stressed by Dr W. Dodd, Nottingham medical officer of health, at the resumed public inquiry into the scheme last Friday. If another power station was built, in addition to that at North Wilford, it would make the level of air pollution truly dangerous, he asserted. The provision of clean air was becoming as important as providing pure water, adequate sewerage and proper sanitation, but the proposals tended to make nonsense of any attempt to establish a clean-air zone, he went on. The 650 ft high chimneys would not remove the danger, only disperse it more widely.

Supporting evidence was also given by a Sneinton general practitioner and the inquiry was subsequently adjourned until 23 Jan., 1961.

Decorative Lighting Dangers

MANY warnings are heard at this time of the year about the danger of Christmas trees or decorations catching fire. However, if the statistics given by the Home Secretary in a written Parliamentary answer last week are comprehensive, it seems that the danger may be less than sometimes supposed. In the period 24 Dec. to 31 Dec. last year, 14 fires attended by fire brigades in England and Wales involved Christmas decorations. Of these, only four were recorded as being caused by electrical faults.

U.S. SHOWCASE FOR PICCADILLY

BOTH the US and Canada are warming up their export drives. The US Government will open a permanent trade centre near Piccadilly next spring to display consumer goods including household appliances. This will be the first Government-sponsored centre outside the US; London has been chosen because Britain is America's best customer after Canada. Mr Mueller, Secretary of Commerce, said in Washington last week that attractive display facilities, at no cost to exhibitors, would be backed by "aggressive" promotion on the part of joint Government-industry teams.

In Ottawa, businessmen from all over Canada are attending export conferences with trade commissioners, and interest in British and Australian markets is particularly heavy. Mr E. J. White, the Canadian Government timber specialist in London, believes there is a wide open market in Britain for domestic appliances such as electric clothes dryers, which are standard equipment in Canada.

Part-exchange Allowances

A REVISED (1960) edition of their booklet on "Used Electrical Appliance Allowances" has been published by the National Electrical Contractors' Trading Association, price 5s. As before, this indicates appropriate part-exchange allowances on a wide variety of appliances up to five years old, but the figures have been revised in the light of suggestions made by NECTA members and additional appliances included.

This display won the £500 first prize for Coopers Ltd. of St. Ebbe's Corner, Oxford in the Morphy-Richards window dressing scheme. Second prize (£250) went to Spooner and Co. (display manager, Mr. V. J. Snelling), Royal Parade, Plymouth, and third prize (£100) to Northampton Co-op. Ten £50 prizes and 25 £10 prizes were also awarded



omation Conference
booked for June

announcement by the reconsti-British Conference on Automation omputation is that a symposium e held at Harrogate from 27-30 next under the general title—ation—Men and Money. This will be followed in the autumn by st annual lecture, which will take rm of a review by an expert of sent position and probable future omation in Britain.

C are now setting up three panels vate various aspects of the orga-n's work. The panels, with their ive chairmen, are: Education and g, Prof G. D. S. MacLellan of w University; research and pment, Mr J. F. Coales of Cam-University; public relations, Mr F. Hessenberg, deputy-director of itish Iron & Steel Research Asso-

e proposals were endorsed by ntatives of the 32 member bodies inaugural dinner which the new an of BCAC, Sir Walter Puckey, at the Waldorf Hotel, London, eek.

TAIL SALES SLACKEN

SSION in the motor and appliance ries has begun to affect retail trade. ional Board of Trade estimates e that retail sales fell by 2% be-October and November. The rise s by clothing and footwear shops eved to have slackened pace, and insufficient to offset the fall in e goods, such as furniture. How- expenditure on personal consumer is buoyant, with tobacco a record nillion in the third quarter. Christ-trade in "cash" goods such as ery and gramophone records looks eing even better than last year, rs say. After allowing for a slight ise, overall sales in November were 2% higher than a year ago.

ayings
OF THE WEEK

e UKAEA is rather like a modern Midas. Everything it touches turns utonium." . . . PROFESSOR W. B. speaking at the Symposium on the reay fast reactor.

e have got into a condition of onous prosperity. I prefer it like . . . LORD BRABAZON OF TARA, y chairman, Electric and Musical tries, at the annual general meeting. ientific management is based on ces which include ensuring that derive satisfaction as well as food their daily work. Management in ountry can be said to have secured gest failure in this direction." . . . H. P. BARKER, chairman, British ite of Management, speaking in ow.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Tuesday, December 13					
	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	234½	-1	ZINC, virgin, min. 98% purity (cash) ...	83½	-2½
" (3 months) ...	230½	-1	" (3 months) ...	84	-2
LEAD, refined pig. 99-97% purity (cash) ...	66	-½	RUBBER, per lb No. 1, RSS, spot ...	25½d	+½d
" (3 months) ...	67	-½	c.i.f. basis, porta. Feb. ...	25½d	+½d
TIN, refined, min. 99-75% purity (settlement) ...	797½	-1½	ARMOURING: Galv. Steel Wire (0-104 in.) ...	68	—
" (3 months) ...	795½	-1½	Mild Steel Tape (0-04 x 1½ in.) ...	53°	—
ALUMINIUM, Ingots 99-99-5% (3 months) ...	186	—	NICKEL (home) ...	600	—
wire bars (4 x 4 x 54") ...	193½	—	MERCURY (76 lb flask) ...	70½	-½
BRASS Strip 63/37 ...	207½	+3	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
SILVER (Troy oz) ...	79½d	—	Lead. (New York) ...	12c	—

* Tape Price, now an average, includes varnishing

EASTERN REGION TRAIN TROUBLE

FAILURE of 25 kV stock on the newly electrified suburban train service out of Liverpool St station has been confirmed by British Railways as being due to breakdown of motor insulation and supply rectifiers under transient voltage conditions. Reasons for occurrence of such apparently extreme conditions is at present obscure.

The trouble affects both three- and four-car multiple stock, whose traction equipment is identical, and these are being withdrawn from service for the time being for thorough investigation by GEC, makers of the equipment.

This withdrawal has also brought considerable upset to time schedules, resulting in very strong criticism by passengers who had anticipated a much improved service with electrification.

Ultra links up with Miles

ULTRA Electronics Ltd. are to purchase a one-third share in Miles Electronics Ltd. The two companies, who are jointly developing the radar simulator for the Navy's new Blackburn Buccaneer aircraft, intend to widen the scope of their activities.



This 225 MVA three-phase generator transformer for Willington "B" power station—claimed to be the largest so far built for the CEBG—was recently shipped from the AEI Transformer Factory, Wythenshawe. Fully assembled, it is 34½ ft long, 19 ft wide and 25½ ft high, and weighs 256 ton

News in Brief

For the 1961 spring term the City of Portsmouth College of Technology has organised a programme of advanced short courses on microwave techniques and on transistors. The latter will be on Thursday evenings, and the former on Monday evenings. Fee for each course, 30s.

The Association of Consulting Engineers have published a new list of members.

Aerialite Ltd. are to hold a series of lectures on their floor-warming system at Polygon Hotel, Southampton, on 14 Feb.; Kimbells, Southsea on 15 Feb. and Hotel Metropole, Brighton, on 16 Feb., all at 7.30 p.m.

Head Wrightson Processes Ltd. have been awarded a contract worth nearly £500,000 for a flue gas washing plant, part of the extension to Bankside power station.

A £24,000 plan to install electric heating under the surface of a half-mile hill at Alfreton, Derbys, has been rejected by the Minister of Transport.

AEI are to transfer telephone cable manufacture from Woolwich to Dagenham.

Ministry of Education hopes to publish proposals for reorganisation of technical education in a White Paper to appear early in January. (Answer to a House of Commons question.)

As in 1958, the Council of Industrial Design will select light fittings and other goods for the Board of Trade's display at the second British Columbia International Trade Fair in Vancouver from 3 May to 13 May next.

Company Activities

JUST as on 27 Oct., when the Bank Rate was cut from 6% to 5½%, so there was no surprise in the City when it was again reduced last week from 5½% to 5%. Logically, there has been only one cut but the operation, for psychological reasons, has been spread over six weeks. It implies no ease in the "squeeze"—a straight 1% reduction in October might have been so interpreted—and is widely recognised as all part of our gesture to further iron out interest rate differentials between the European economies and that of the United States, embarrassed by the continuing drain on its gold holding and its deteriorating balance of payments. So stock markets in London which theoretically might have been expected to firm up with a fall in the prime money rate did precisely the opposite. Economic prospects at home, thickly surrounded with gloom so long as our export/import position tends to worsen rather than improve, are exerting a far greater down-pull on market prices than the upward tendency which would be the normal response of capital values to a chop in the price of money.

In fact, after the Bank Rate announcement the "short" end of the Gilt-Edged Market did go a little harder, à la textbook, but the mighty War Loan dropped to a new 1960 "low" of £59½, typical of the weakness displayed by the undated stocks, while the *Financial Times* industrial ordinary index toppled a further 1.4 points to a then new low of 294.6 for the year. Later, it dropped yet again to 293.4.

As will be seen from my table, leading electrical shares for the most part were inclined to soften rather than improve, with AEI at a new "low" for the year. News of short-time working at one of its "Hotpoint" refrigerator factories, of course, contributed to this result and both English Electric and GEC were easier in sympathy.

Berry Trust

This concern, whose investments include a substantial holding in Berry's Electric Magicoal, is paying an interim dividend of 10% for the year to 31 Aug., 1961, and a higher profit and total payment than that foreshadowed when the company was made public last September is now forecast. Estimated profit should be not less than £41,000—against £34,000 originally expected—and if this is realised, total distribution will be 33½%, compared with the previous indication of 28%.

Brook Motors Ltd.

Trading profit for the year to 30 Sept. last increased to £681,917 from the previous year's total of £572,436. A final of

On the brighter side, Plessey scored a gain of 3d over the week on the full report from chairman Mr A. G. Clark, who told us that the group's profit in the first 4 months of their current year (July-October) shows no material change from that of the corresponding period.

At the yearly meeting of Electric and Musical Industries, deputy-chairman Lord Brabazon told shareholders that the company had got itself into a condition of "monotonous prosperity." Earlier, chairman Sir Joseph Lockwood had gone

Electrical Share Movement Either Side of Bank Rate Change
(Middle prices at close of days' business)

SHARE	5 Dec.	7 Dec.	8 Dec. Bank Rate cut from 5½% to 5%	9 Dec.
A.E.I. £1 ...	40/9	40/-	39/9	39/6
Berry's Elect.				
Magicoal 5/- ...	50/-	50/-	48/9	48/9
B.I.C.C. £1 ...	49/6	48/6	48/6	48/1½
E. K. Cole 5/- ...	19/7½	19/4½	19/-	18/7½
Crompton, P. 5/-	11/3	11/1½	11/1½	11/1½
Decca Rec. 10/-	49/6	49/6	49/6	49/6
E.M.I. 10/- ...	41/9	42/-	42/3	42/-
Ell's Auto. 5/- ...	24/6	24/1½	23/3	22/10½
English Elec. £1	32/6	31/7½	31/-	30/9
G.E.C. £1 ...	30/6	29/10½	30/-	30/-
Hoover 5/- "A"	41/9	40/3	40/3	40/-
Parsons, C. A. £1	46/-	45/6	45/-	45/-
Plessey 10/- ...	43/9	43/-	44/3	44/-
Thorn Elec. 5/- ...	45/6	45/6	45/6	45/7½
Ultra Elec. 5/- ...	13/3	13/-	12/9	11/7½

better than Plessey when he made known that EMI's group turnover, which now includes Morphy-Richards and Ardenite, had risen 5% over 1959/60 in the first four months of its current year, i.e., from July to October inclusive.

Ultra Electric (Holdings) might have been expected to have moved higher rather than lower on being the first British manufacturer to launch a "19-inch" t.v. set, but the fall from 13s 3d to 11s 7½d anticipates similar news from others.—*From our City Correspondent.*

20% makes the total distribution again 25% on capital as increased by a one-for-six scrip issue.

Dawes Radio Group

A quotation is being sought in London and Manchester for the capital of this group, which has 36 shops in the Manchester area, operating rental and retail sale of TV and radio sets and the larger domestic appliances. The capital consists of 125,000 7% £1 Redeemable Cumulative Preference shares and 720,000 Ordinary 5s shares. Profits for 1959-60, subject only to tax, were £106,000 and for the current period ending 30 June next the directors expect profits to be not less than £111,000, with a forecast of a 20% dividend.

Engineering and Lighting Equipment Co.

Along with a change of name to Eleco Ltd. the directors propose to obtain an up-to-date valuation of the plant and buildings owned by the company and its subsidiaries. The financial year is also to end on 30 June in future and, accordingly, the current period will be extended to 15 months. In the circumstances, the directors are to consider payment of a further interim dividend for the current period about May, 1961.

Ericsson Telephones Ltd.

Of the 1,600,096 Ordinary 5s shares offered at 18s each, acceptances were received in respect of 1,565,294 shares.

Kalgoorlie Electric Power and Lighting Corpn.

In view of the necessity to conserve resources with a view to modernising plant, £50,000 has been placed in a plant modernisation reserve. This question of modernisation is an important one and involves agreement with the major consumers on the future supply of current. Negotiations with the latter have already started both on re-equipment of the station and the problem of financing that work.

Oliver Pell Control Ltd.

The reduction of trading profit to £10,219, from the previous year's total of £37,908, was largely attributable to heavy expenditure incurred in the continued expansion of the company's production facilities, the directors point out. After depreciation and other charges, there was a loss of £14,239 for the year ended 31 March last, but the dividend is again 6%.

Plessey Co. Ltd.

While some of the industries this company serves have not been having an easy time this year, others are busy and the company's profits for the first four months show no material change from those of the corresponding period of last year, Mr A. G. Clark, the chairman, reports. The directors consider that the prospects for the further development and extension of the business are good. Cash and investments at the end of June last stood at £6,649,157 and the new rights issue will provide an additional £9,533,000, which is to be employed in new plant and buildings to produce new products, purchase other businesses and establish additional overseas companies.

Dividends Declared

Aiton and Co. Interim 4% (same).
Electric and General Investment. Interim 3% (same), but on increased capital.
Garrard Engrg. and Manfg. Interim 4% (same).
Hawker Siddeley Group. Second interim 5%.
Hick Hargreaves and Co. Interim 5% (4%).
Lisbon Electric Tramways Interim 2% tax free (same).
Telephone Rentals. Interim 5% (same).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

are the final for receipt of unless otherwise stated.

Stockport T.C. Electrical installation of dormitory wing and extension at Aged Person's Home, Bramhall Dec. issue.

Brantree and Bocking U.D.C. Contractors on N.I.C.E.I.C. rolling houses. Engineer and Surveyor, Anlaby Hse, Deposit £1 ls.

Bristol T.C. (2) Electrical installation of N.I.C.E.I.C. rolling hall extension, new kitchen accommodation at Baptist Mills School. Applications to City Council Hse, by above date. tenders for fixed price and required.

Derby B.C. Supply of lamps, cables and accessories for year 1962. Borough Engineer and M. L. Francis, Council Hse.

Dumbarton C.C. Erection and supply of fluorescent street and foot-lights comprising: 35 points Seaford 88 points Maurhead—4 area at Ald.—See 8 Dec. issue.

Harrogate and Ripon Hospital. Applications invited for improved list for electrical, radio and television maintenance. Applications to Secretary: F. M. Haughton, Hereford, Cornwall Rd, Harrogate, by 1 Dec.

Maldstone B.C. Electrical installation of 13 London Rd into people's hostel.—See 1 Dec. issue.

Montgomeryshire C.C. Electrical installation in: Bettws School and canteen; Llangynidr School, canteen and head house; Bont School, canteen and head house. Director of Education: J. E. Jones, Education Offices, Newtown.

Rochester C.C. Electrical installation of fixed-price basis in 36 houses, state.—See 8 Dec. issue.

Sunderland B.C. Electrical installation of maternity and Child Welfare Clinic, Seaton estate.—Advertised 24 Nov.

Wandsworth B.C. (h) Supply of 1 (i) electrical works for year from 1961.—See 24 Nov. issue.

Birkenhead B.C. Supply of lamps for year.—See 1 Dec. issue.

Liverkeithing B.C. Electrical work on ten dwellings of four and five rooms at Preston Cres. Applications to Clerk, R. Mitchell, Burgh Chambers, date.

Fylde Water Board. Electrical installation in Hodder Wks, Slaidburn. Engineer, Sefton St, Blackpool.

N.I. Housing Trust. Electrical installation in 62 dwellings at Greenisland. Engineer, 12 Hope St, Belfast.

Nottingham T.C. Supply of (Item 10) and accessories.—See 1 Dec. issue.

West Lothian C.C. Supply and installation of 31 200 W sodium lamps on columns with 10 ft 6 in. outreach at Starlaw and A8/A899 Broxburn lighting.—See 24 Nov. issue.

Southampton B.C. (a) Electrical installation of new Millbrook Secondary School and (b) electrical installation of new Eyre Secondary Boys' School. Dec. issue.

Fareham U.D.C. Supply and installation of sewage pump, complete with motor and gear for Peel Common.—See 8 Dec. issue.

Ealing B.C. Electrical installation at St. Ann's Secondary Girls' School, Springfield Rd.—Advertised 1 Dec.

23 Dec.—Brentwood U.D.C. Supply of (Tender 22) lamps for year. Engineer and Surveyor, Council Offices.

23 Dec.—Eastleigh B.C. Supply of (Item 10) street lighting lamps for year from 1 April, 1961.—See 8 Dec. issue.

28 Dec.—Haltemprice U.D.C. Supply of (Schedule 18) street lighting lamps and tubes. Engineer and Surveyor, Anlaby Hse, Anlaby.

28 Dec.—Prestwich B.C. Supply and erection, on fixed-price basis, of 26 reinforced concrete columns with 24 fluorescent and two sodium lamps/gear along Rectory Rd and 27 concrete columns with sodium lighting at King's Rd, plus removal of 31 existing units. Borough Engineer, Town Hall.

30 Dec.—Denby Dale U.D.C. Supply, erection and wiring of 225 25 ft Stanton concrete columns together with 140 W sodium lamps/lanterns/gear along A636 Wakefield Rd and A635 Barnsley Rd.—See 8 Dec. issue.

30 Dec.—Monaghan C.C. (b) Erection and installation of two pumping sets to deliver 28 g.p.m. at a 106 ft head for Rockcarry scheme. Supply and/or erection of two 42 g.p.m. pumps at a 128 ft head for Newbliss.—See 1 Dec. issue.

31 Dec.—Llanfyllin R.D.C. Electrical installation in new offices.—See 8 Dec. issue.

2 Jan.—Droitwich B.C. Supply and erection of 52 street lamps, together with lanterns/gear/wiring. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.—Advertised in this issue.

2 Jan.—Romford B.C. Supply of 200 W sodium lamps/lanterns/gear/brackets for conversion of 69 existing units. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.

2 Jan.—Romford B.C. Tender M26. Supply of lamps for year. Borough Engineer, Town Hall.

3 Jan.—Manchester C.C. Provision of road and car park mercury vapour lighting at Manchester Airport. City Surveyor, Town Hall.

3 Jan.—Radcliffe B.C. Supply and installation of 43 140 W sodium lamps on 25 ft columns and brackets, plus removal of 28 existing units along A667, Ringley Rd.—See 1 Dec. issue.

4 Jan.—Manchester C.C. Electrical services installation in Central Technical College, Manchester 15. City Architect, P.O. Box 488, Town Hall.

5 Jan.—Belfast C.C. (a) Electrical installation in Fane St Secondary School.—See 8 Dec. issue.

6 Jan.—Belfast C.C. (a) Supply of condenser tubes and (b) supply and erection of 25 kW germanium diode rectifier sets (Specifications W184 and 5, respectively).—See 8 Dec. issue.

6 Jan.—Camberwell B.C. Supply of (Item k) lamps and (Item s) cables, conduit and fittings. Borough Engineer and Surveyor, Town Hall, S.E.5.

6 Jan.—Kilkeel. Electrical installation in Holy Cross Primary School. Documents from consulting engineer, C. P. McNally, 143 Royal Ave, Belfast. Deposit £3 3s.

6 Jan.—Wanstead and Woodford B.C. Supply of (Item 13) for year.—See 8 Dec. issue.

6 Jan.—Wood Green B.C. Supply of (Item 17) lamps for one, two or three years. Borough Engineer and Surveyor, Town Hall, N.22.

7 Jan.—Baldock U.D.C. Supply and erection of 11 25 ft concrete columns with 140 W sodium lighting. Engineer and Surveyor, Council Offices. Deposit £2 2s.

7 Jan.—Bath C.C. Supply of (Item 40) l.v. cables; (41) discharge lamps; (42) tungsten lamps and fittings; (43) steel and concrete columns; (44) street lighting lanterns; (45) control gear and capacitors; (46) time switches, for year.—See 8 Dec. issue.

7 Jan.—Dagenham B.C. Supply of (Item 31) lamps for year. Borough Engineer and Surveyor.

9 Jan.—Swansea B.C. Two disintegrator sets, pipes, valves, control gear, switches, switchboard, etc., for Limeslade Sewerage Scheme. Borough Engineer and Surveyor, R. D. Moody, The Guildhall.

10 Jan.—Dumblane B.C. Supply and erection of seven Group "A" concrete columns/lanterns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. issue.

11 Jan.—Tonbridge R.D.C. Wiring, by registered contractors, of Council Offices and proposed extension 48 Pembury Rd. Engineer and Surveyor, 48 Pembury Rd.

16 Jan.—Bermansley B.C. Supply of lamps for year.—See 8 Dec. issue.

17 Jan.—Newcastle upon Tyne C.C. Supply and installation of two automatic passenger lifts in each of two 15-storey blocks of flats at Longbenton estate.—See 8 Dec. issue.

28 Jan.—Camborne-Redruth U.D.C. Supply of (Item 24) electrical equipment and fittings for year.—See 8 Dec. issue.

1 Feb.—Oxford T.C. Supply and erection of

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an Index of trade information with over 100,000 entries

A Selection from the 109 queries answered this week

"Fairline" washing machines—makers of? Y.E.B.—Fairline Electrical Products Ltd., High Bank Mill, Godley, Hyde, Cheshire.

"Salmic" toaster elements—address for spares? L.E.B.—Metway Electrical Industries Ltd., Kemp Town, Brighton 7, Sussex.

"Everay" H.F. violet ray equipment—address for? L. and C.—Watson and Sons (Electro-Medical) Ltd., East La, North Wembley, Middx.

"Q-Max" chassis cutters—makers of? W.E.S.—"Q-Max" (Electronics) Ltd., Napier Hse, High Holborn, W.C.1.

"Grillfix" infra-red grillers—agents for?

M.A.N.W.E.B.—Fairfax Engineering Ltd., 1 Regency Parade, Finchley Rd, N.W.3.

"Toastermaster" toasters—agents for? B.E.—Frank V. Magrini Ltd., 24 Royal College St, N.W.1.

"Infralux" heat-light fitting—makers of? T.E.—Selex Electric (Kirkby) Ltd., Yardley Rd, Industrial Estate, Kirkby, Lancs.

"Nura" lamps—makers of? P.E.—Omega Lampworks Ltd., Albany Wks, Burlington Rd, New Malden, Surrey.

Mlag, Braunschweig, Germany, makers of grinding machines—agents for? E.T.—D.M.M. Machinery Ltd., 60 Buckingham Palace Rd, S.W.1.

two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. issue.
No date stated—Loch Lee Water Board. Supply and installation of switchboards, wiring, lighting and heating installations for first phase Loch Lee scheme. Documents from engineers: Crough and Hogg, 18 Woodside Cres, Glasgow C.3. Deposit £5.
No date stated—North of Scotland H.E.B. Supply and erection of 132 kV steel tower double circuit spur line to Burghmuir.—Advertised 8 Dec. issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

20 Dec.—Argentina. 10,000 s.-ph. and 500 three-phase meters. Direction Energia, Ministerio de Obras Publicas, Calle 6, No. 636, La Plata, Buenos Aires. B.o.T. (ESB/32323/60).*

20 Dec.—Ceylon. 33 kV "D" fuse brackets for pole mounting. Chairman, Tender Board, Dept. of Government Electrical Undertakings, P.O. Box 540, Colombo. B.o.T. (ESB/32417/60).*

20, 21 and 22 Dec.—India. L.T. switchgear, transformers and h.t. switchgear. Purchase Officer, Trombay Establishment, Mohatta Bldg, Palton Rd, Bombay. B.o.T. (ESB/31865/67/60).*

21 Dec.—America. (1) Ten disconnecting switches, horn gap switch and three interrupter switches; (2) Four 230 kV 1,200 A disconnecting switches. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Bldg 53, Denver Federal Center. B.o.T. (ESB/31340 and 31475/60).*

22 Dec.—Burma. Electronic equipment, 13 items. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/31892/60).*

23 Dec.—Netherlands. Generators for four Tacan Stations. N.A.T.O. Infrastructure contract ICB.99. Directeur Gebouwen, Werken en Terreinen, Kalvermarkt 28, The Hague. B.o.T. (G.D.5758/14).

23 Dec.—Portuguese East Africa. Power distribution network for Vila Cabral. Public Works Dept., Lourenço Marques. B.o.T. (ESB/31747/60).*

28 Dec.—Kuwait. 500 fluorescent fittings and 1,900 plastics shades. Dept. of Electricity, Water and Gas. B.o.T. (ESB/21815/60).*

30 Dec.—Burma. Lighting fittings and accessories, 28 items. Clement Mills, Ind. Development Corpn., Thayetmyo. B.o.T. (ESB/31904/60).*

30 Dec.—India. 100 tons h.d. bare solid copper-conductors from 1 to 10 s.w.g. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/31843/60).*

4 Jan.—Kuwait. 1,000 mercury vapour lanterns complete with control gear, steel poles/brackets and street lighting cutouts. Dept. of Electricity, Water and Gas. B.o.T. (ESB/31829/60).*

10 Jan.—Ceylon. 2, 5 and 10 kW spot-

lights, bulbs, cables, etc. Chairman, Tender Board, Ministry of Defence and External Affairs. B.o.T. (ESB/31819/60).*

15 Jan.—Kuwait. 70,000 yd 11 kV, 0.25 sq in. 3-core p.i.l.c. cable and junction boxes. Dept. of Electricity, Water and Gas. B.o.T. (ESB/31812/60).*

16 Jan.—Ghana. Tender: ELEC. 4023/1, 61,000 yd l.t. underground cable. Tender: ELEC. 4024/1, 29,000 yd h.t. underground cable. Secretary, Ghana Supply Commission, P.O. Box M.35, Accra. Documents fee: £G1.—Advertised in this issue.

18 Jan.—Ceylon. Six and 12 V batteries. Crown Agents, 4 Millbank, London S.W.1. B.o.T. (ESB/31468/60).*

19 Jan.—India. 21 outdoor transformers and equipment for electrical repair shop. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/29420/60).*

24 Jan.—India. Electrical testing equipment for Amarkantak thermal station scheme. Superintending Engineer (Projects), Madhya Pradesh Electricity Board, Jabalpur. B.o.T. (ESB/31864/60).*

26 Dec.—India. 95,800 yd 660 V aerial cable. Chief Engineer (South), Stores Purchase Section, The Mall, Patiala. B.o.T. (ESB/31905/60).*

TRADE NOTES

New Depot. The General Electric Co. has opened a new depot at Crawley, which replaces the old premises at Brighton. Ample parking space is provided. Manager at Crawley is Mr G. Knight, formerly deputy manager at Brighton.

Expansion. Birmingham Battery and Metal Co. Ltd. have purchased the Redditch factory of Eccles (Birmingham) Ltd., whose main premises are at Stirchley.

Service. Magnavox have this week opened a new Dealer Service Dept. at 20-22 Corsica St, Highbury, N.5 (telephone: Canonbury 5041), where Mr F. W. Stanhope is in charge.

Marketing. From 1 Jan., 1961, marketing arrangements for the "Reguplug" will be taken over by the Distribution Equipment Sales Dept., A.E.I. Cable Division, 155 Charing Cross Rd, W.C.2.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Evolux Ltd., 15 High St, Langley, Oldbury, Birmingham. Manufacturers of and dealers in electrical and other equipment, etc. Nom. cap.: £100. Dirs.: Philip W. Peters and Evelyn J. Peters.

F. and B. Electrics (Contracts) Ltd., 215 High St, Hounslow, Middx. Nom. cap.: £100. Dirs.: Edwd. A. Brimfield and Mrs J. L. Brimfield.

M and A (Cambridge) Ltd. Electricians, etc. Nom. cap.: £1,000. Dirs.: Dennis F. Morgan, Red Roofs, Histon, Cambridge; and Maurice E. Allgood, 18 Redfern Close, Cambridge.

CONTRACTS PLACED

Durham C.C. Electrical installations in: Bearpark County School, G. Tregoning, £773; new village hall, Middleton-in-Teesdale, N. of England Eng. and Electrical Co. Ltd., £705. Recommended.

Heston and Isleworth B.C. Installation renewals and additional power points in 92 houses, Worples estate, Hughes Electrical Ltd., £1,669. Recommended.

Islington B.C. Supply and erection of main road columns/lanterns, Harland and Wolff Ltd., £22,596. Recommended.

Kirkburton U.D.C. Supply and installation of 88 200 W sodium lighting on 35 ft columns along Penistone Rd, Anderson and Heeley Ltd.

Liverpool C.C. Supply of distribution board for South Sewage Disposal Wks, English Electric Ltd., £898 13s; supply of lamps, Downes and Davies Ltd., Philips Electrical Ltd. and Atlas Lighting Ltd. Recommended.

Newcastle upon Tyne Hospital Board. Electrical work in: Winterton Hospital, N. of England Eng. and Electrical Co. Ltd., £2,537; new pathological laboratory, Sunderland Royal Infirmary, Selborne Eng. Co. Ltd., £1,093. Staff location systems at Newcastle General and Dryburn Hospital, Multitone Electrical Co. Ltd., £4,635 and £2,369 10s, respectively.

Northumberland C.C. Stage lighting installation, Morpeth Newminster Secondary School and rewiring Pegswood central kitchen, J. and A. Oliver Ltd., £320 % and £307, respectively. Electrical installation, Stakeford Primary School, Mood and Son, £824. Electrical installation renewal, Berwick Grammar School, S. of Scotland E.B., £1,564. Electrical installation, Birtley C.E. Controlled School, J. Robinson (Electrical) Ltd., £507. Recommended.

Peterborough C.C. Electrical installations in 98 dwellings, Bluebell estate, M. F. Hansen, £2,297 10s.

Wessex Hospital Board. Electrical work: Firs Hospital, Bournemouth, conversions, E. W. Forster and Co., £5,308; St. James Hospital, Portsmouth, G. E. Taylor (London) Ltd., £1,983; Salisbury General Infirmary, R. F. Webb Ltd., £858; Lord Mayor Treloar Hospital alterations, etc., R. F. Webb Ltd., £2,325. Recommended.

Mactric Electric Ltd., 43 Raydon St, N.19. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Henry J. Knights and James McAneny.

Power Electrical (London) Ltd., 101 High St, Orpington, Kent. Nom. cap.: £1,000. Dirs.: Frank E. Baker and Paul Trummel.

Queensway Electrical Ltd., 97 Queensway, W.2. Manufacturers of and dealers in washing machines, refrigerators, etc. Nom. cap.: £100. Dir.: Harold Freedman.

Shawford Control Gear Co. Ltd., Midland Terr, Victoria Rd, N.W.10. Nom. cap.: £2,500. Dirs.: Charles F. Ford, Peter L. Norton, Eric C. L. Basan and Donald C. Ambrose.

Simon-Carves (Japan) Ltd., Bird Hall La, Cheadle Heath, Stockport. To carry on business of mechanical, chemical, civil, electrical, constructional or nuclear engineers, etc. Nom. cap.: £10,000. Dirs.: David T. Barrit, Leopold Brook, Hubert Clarke, Norman Hinton and John P. V. Woollam.

A. E. Southey and Co. Ltd., 22 The Broadway, N.14. Electricians, etc. Nom. cap.: £12,000. Dirs.: Albert E. Southey, Albert R. Southey, Mrs Daisy G. Southey and Gertrude B. Southey.

Wilson and Harper Ltd., 29 Cross St, Macclesfield. To take over business of electrical contractors carried on at Macclesfield by Derrick Wilson and Gordon H. Harper, etc. Nom. cap.: £5,000. Dirs.: Derrick Wilson, Gordon H. Harper, Mrs Norma C. Wilson and Mrs Violet M. Harper.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Auto-Home. B789,817. Class 8. Shaving instruments. Sperry Rand Corpn., 100 West Tenth St, Wilmington, Delaware, U.S.A.

AT in design. B800,480. Class 9. Semiconductor devices. Associated Transistors Ltd., Stonefield Way, Victoria Rd, Ruislip.

Amplilite. 802,365. Class 9. Telephonic and radio telephonic apparatus. Amplivox Ltd., Beresford Ave, Wembley.

G. Matic. 795,756. Class 7. Washing machines, etc. Bylock Electric Ltd., 109 South St, Enfield.

Powramp. 805,951. Class 9. Apparatus, etc. Plessey Co. Ltd., 1 Broad St Pl, E.C.2.

Rayglo. 808,352. Class 10. Blankets. Cupal Ltd., Phoenix Mill, King St Bridge, Blackburn, Lancs.

Sumray. 801,992. Class 11. Electrical conductor heaters, etc. L. G. Hawkins and Co. Ltd., 30-35 Drury La, W.C.2.

Tootal. 796,145. Class 9. Apparatus, etc. Thermo Plastics Ltd., Luton Rd Wks, Dunstable.

Transcap. 808,637. Class 9. Condensers. Erie Resistor Ltd., Millora Wks, Beevor Rd, South Denes, Gt. Yarmouth.

BUSINESS PROSPECTS

Stoke. Percy Bilton, 54 Uxbridge, plan factory and offices covering 1 ft off Winchester Rd.—Wilkinson Ltd., Sword Wks, Southfield Rd, an Houndsmills estate factory.—street lighting scheme, South Hand estate, planned.

Stoke B.C. Tender: Four-storey block shops with flats and maisonnettes, Ave, Mill Park estate. Engineer.

Stoke. Young and Mackenzie, 2 Welling-Belfast, architects for new halls of at Queen's University.

Suffolk (Essex). N.E. Metropolitan Hospital, 40 Eastbourne Terr, W.2, plan conversion at St. Andrews Hospital as accommodation.

Suffolk. Marcus Leaver and Co., 36 St, W.1, plan supermarket and three Central Shopping Area.—Robert 2 Halkin St, Hyde Park Corner, architect for three-storey office building St and Market St for C. L. properties.

Suffolk. Westhill Training College, K, Birmingham 29, plan £100,000 extensions at Bristol Rd.

Suffolk. £2,000 lighting scheme, Talbot named between Larkhill St and St; £24,800 improved lighting planned for Gynn Sq/Morbeck secromenade.

Suffolk. Bromilow and Edwards, Foundry accommodation of all their produc-adjacent ten-acre site.

Suffolk. Arndale Property Trust, Howard St, plan rebuilding of The Swan Market St.

Suffolk. D. Plaskett Marshall and Ptnrs, on Sq, W.C.1, architects for Barnaby youth hostel.

Suffolk. U.D.C. Tender: Three blocks sons' flats, each of eight-, one-oom flats on fixed-price basis, Black housing site. Surveyor.

Suffolk. Morgan and Carn, 12 Grand ave, Sussex, architects for Jaycee's Woodingdean factory and Eagle urance Co.'s offices.

Suffolk. T.C. to approve scheme for scheme for handicapped people at ough Sq, Lockleaze.

Suffolk. Education Committee Tender: w laboratories and canteen exten-omley County Grammar School for igher.

Suffolk. Diocesan Trustees of Clifton, lan R.C. secondary school, Arle Rd. r. Liverpool Hospital Board plan Moston Military Hospital adapta-provide accommodation for 330

Suffolk. Sir Hugh Casson, 33 Thurloe 7, architect for rebuilding 1 and 2

Suffolk. burst and Sideup. U.D.C. plans street lighting improvements on 40

Suffolk. Associated British Cinemas, 30 Sq, W.1, plan cinema and associated nent at junction Hill St/Corporation place Empire Cinema.—Sketchley, Precinct, plan dry cleaning works, shops of Hales St Opera Hse site.

Suffolk. C.C. Tender: Stage 3, Primary School. Acting County t: H. R. Clark, 15 Portland Sq,

Suffolk. Southern United Telephone Chequers La, plan cable drum shop ufacturing building.

Suffolk. B.C. plan £23,240 Stage 4 of hting conversion scheme.

Suffolk. U.D.C. Tender: 48 "Holme- houses. Surveyor.

Suffolk. Monotype Corporation, Sal- Surrey, plan factory to employ

Suffolk. Education Committee plans elec- wiring of West Stanley Front St

County School at £2,000 and Birtley George St County and Modern, £2,200.

Eastington. R.D.C. plans £7,528 improve- ment of electrical facilities in over 2,000 pre-war houses.

Eastbourne. £5,458 street lighting scheme planned for Victoria Drive/Green St/Wil- lington Rd.

Edinburgh. Works Committee plan £125,000 conversion of street lamps to electricity; £50,000 improvement of lighting in streets already electrically lit and £23,000 street lighting for new housing schemes.

Felling. Newcastle Hospital Board, Ben- field Rd, Newcastle, plan alterations at Windy Nook Hospital to provide offices.

Flint B.C. Tender: 39 bungalows, High- field, Bagillt. Engineer.

Gateshead. Gateshead and District Co-op. Society plan conversion of Jackson St masonic hall into shops. C.W.S. Architect's Dept., 90 Westmorland Rd, Newcastle.— E. M. Lawson, Barras Bldgs, Barras Bridge, Newcastle, architect for Hardy and Co.'s central offices on site of disused Shipcote Cinema, Low Fell.

Grays, Essex. N.E. Metropolitan Hospital Board, 40 Eastbourne Terr, W.1, plan £335,000 Ossett Hospital extensions.

Grimsby. D. Byford and Co., Abbey La, Leicester, plan Immingham factory.

Hartlepool. Newcastle Hospital Board, Benfield Rd, Newcastle, plan out-patients' dept. offices at Hartlepool Hospital.

Hastings. Hastings Grammar School, off St. Helens Rd, 'near Alexander Park estate, planned to cost £215,000.

Hatfield R.D.C. Tender: 30 dwellings, School La, Essendon. W. J. Davis, 82 Gt. North Rd, Engineer and Surveyor.

Heston. Middlesex C.C. plan £115,000 Vicarage Farm Rd home for the aged. Architect: H. J. Whitfield Lewis, Queen Anne's Gate Bldgs, Dartmouth St, S.W.1.

Irvine. Elliott, Cox and Ptnrs, 172 Buck- ingham Palace Rd, S.W.1, architects for Skefko Ball Bearing Co.'s factory.

Kettering. Oxford Hospital Board, Ban- bury Rd, Oxford, plan £600,000 extensions to General Hospital.

Kingswood, Bristol. Rank Organisation, 11 Belgrave Rd, S.W.1, plan £200,000 con- version of Odeon Cinema into bowling alley.

Leeds. Gillinson and Barnett, 8 Queen's Sq, Leeds 2, architects for Grant Leeman and Co.'s flattened factory, warehouse and offices on North St area site.

London. Sumner and Derwent, 151a Queensway, W.2, architects for J. G. Ingram and Sons', Prince Edward Rd, E.9, factory.—Bonstan Engineering Co., 24 Runtun St, N.19, plan extensions.—Crosher and James, 329 High Holborn, W.C.1, quantity surveyors for Worshipful Company of Inn- holders' Coleman St additions.—Brixton Development Co., Ely Pl, E.C.1, plan multi- storey industrial and office block, shops, maisonnettes and flats, Hatton Gdn/Leather La, E.C.1.—A. Kenyon, Taute and Ptnrs, 140 Park La, W.1, architects for Camberwell Grove, S.E.5, offices and dwellings.— Lutyens and Greenwood, 13 Mansfield St, W.1, architects for Royal Institute of International Affairs' £50,000 extensions at St. James's Sq, S.W.1.—F. N. Bateman, 81 High St, Wimbledon Common, S.W.19, agents for Norman Property Co.'s 101 flats, Priory La, S.W.15.—Veale and Sanders, 19 Hanover Sq, W.1, quantity surveyors for Berners St, W.1, offices and showrooms.— W. R. Orme and Ptnrs, 44 Manchester St, W.1, architects for Druce and Co's shop and office plan at Baker St and Broadstone Pl, W.1.—Royal Institution of Chartered Surveyors plan new H.Q. building at 11-12 Gt. George St, S.W.1.—C. Lovett Gill, 41 Russell Sq, W.C.1, architect for 12-storey block of shops and offices, Victoria St, S.W.1.—City of London Real Property Co, plan ten-storey building on Goringe's Hotel site, 1-9 Warwick Rd and 25 Allington St.

Loughborough. Scheme for 13 Group "A" 400 W mercury fluorescent lamps at Derby Rd and 31 250 W mercury fluorescent lamps at Bishop Meadow Rd at £840 and £1,930.

Manchester T.C. Tender: Alterations and additions to St. Thomas C.E. School, Ard- wick. Architect.

Margate. Tender: Factory at Westwood, for Pearce Signs Ltd. Prall and Prall, 57 High St, Bexley, Kent. Architects.

Middlesbrough B.C. Tender: Tropical and sub-tropical houses, Stewart Park; electric lighting and power with complete low pressure heating suitable for tropical and sub-tropical plants. Engineer.—B.C. Tenders: Easterside Group 29, 26 and 30, for 30 houses, 21 houses and 28 houses with flats and garages. Engineer.

Newcastle T.C. Tender: Installation of two automatic passenger lifts in each of two 15-storey flats blocks, Longbenton estate, Unit 4. Architect.

Newport, Mon. Stage one of Royal Gwent Hospital rebuilding scheme (£1½ million) to begin soon. It includes four operating theatres and kitchens. Welsh Regional Hos- pital Board, Cathays Park, Cardiff.

Norwich. T.C. plans £40,300 North Park Ave hostel for old people.

Notts T.C. Education programme includes £62,000 Newark training centre and £21,000 extensions to Mapperly training centre.— T.C. plans improved lighting schemes for Sneinton Hollows, Castle St, etc., at £1,110.

Oxford. G. R. Cooper (Oxford), St. Ebbes Corner, Oxford, plan four-storey warehouse with offices and showrooms, Paradise St.

Portsmouth. Birch and Jacques (Tool- makers), Hershman Trading Estate, Hershman, Walton-on-Thames, plan Leigh Park factory.

Redruth. Cornwall C.C. approve plans for £59,775 psychiatric old people's home and £54,950 junior/adult mental health training centre, Drump Rd.

Rochester. Yorke, Rosenberg and Mardall, 2 Hyde Park Pl, W.2, architects for Elliott Bros.' £336,000 electronics factory.

Royston U.D.C. Tender: 76 Doles estate dwellings. Surveyor.

Salisbury. Extensions and rebuilding of Godolphin School approved by T.C. Plans include new boarding house, modernisation of existing boarding houses, kitchens and dining rooms.

Sandwich B.C. £1,217 plan for 35 ft concrete standards with metal extensions, Ramsgate Rd; and 25 ft concrete standards at Dover Rd, £1,581 and £1,217.

Shrewsbury. Education Committee plan £77,700 scheme for additional accommoda- tion at Walford Farm Institute, and similar £44,000 scheme at Radbrooke College of Domestic Science.

Southall B.C. Scheme for 140 W lamps, Tentelow La.

Sowerby Bridge U.D.C. Tender: 38 bunga- lows and meeting room, Bairstow La. Engineer.

Sunderland. Newrick and Blackbell, 58 John St, architects for Ericsson Telephones works extensions.—Corporation plans Town End Farm estate shopping centre. Borough Architect.—Junior and infant school planned on Town End Farm estate. Architect.

Sutton and Cheam B.C. Tender: 36 living units in one- and two-storey construction on two sites. Engineer.

Warwickshire. Health Committee plans £40,550 clinic at Warwick.—Loveday and Davis, 42 Regent Pl, Rugby, architects for old people's home.

Welwyn Garden City. Paul Manger, Gavin, Mathers and Mitchell, 31 Church St, Welwyn, architects for £40,000 hostel for National Spastics Society.

West Kesteven R.D.C. Tender: 20 dwell- ings in Westborough and Skillington parishes. Surveyor, Sandon Cl, Grantham.

Weston-super-Mare B.C. Tender: 26,000 sq ft factory with two-storey offices. Clerk.

Worcester. £22,000 extensions to Royal Infirmary planned.

Wrexham B.C. Tender: 66 dwellings, Montgomery Rd; and 14 dwellings, Lorne St/Park St. Surveyor.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Merseyside Eng. (Refrigeration) Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 19 Dec. Persons intending to appear to notify Slaughter and May, 18 Austin Friars, E.C.2, by 1 p.m., 17 Dec.

J. and D. Clayton (Edgware) Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 19 Dec. Persons intending to appear to notify Isadore Goldman and Son, 11-13 Southampton Row, W.C.1, by 1 p.m., 17 Dec.

Hobson and Hammond (Electrical) Ltd. Meeting of creditors to be held at 93 Queen St, Sheffield 1, on 15 Dec., at 11.15 a.m.

Pearl Industries Ltd. Mr P. R. Hackett, 18 Greenfield Cres, Edgbaston, Birmingham 15, appointed liquidator at extraordinary general meeting on 24 Nov.

Don Electrical Co. Ltd. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed liquidator at extraordinary general meeting on 28 Nov.

Reeves Electrical and Radio Co. Ltd. Meetings of creditors and contributors to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 15 Dec., at 2.30 and 3 p.m.

Safe-Beam Lamp Ltd. Dividend per £: 2s, payable at Official Receiver's Office, Somerset Hse, 27 Temple St, Birmingham 2, on 22 Dec.

Oldham Electrical Co. Ltd. Meetings of members and creditors to be held at offices of Poppleton and Appleby, 31 Lloyd St, Manchester 2, on 21 Dec., at 10 and 10.30 a.m., respectively, for the purpose of having an account of liquidation laid before them.

Madras Electric Supply Corpn. Ltd. General meeting of members to be held at 30 Cursitor St, E.C.4, on 30 Dec., at 11.35 a.m., to receive the liquidator's account of the winding-up.

Perryvale Electrical Appliances Ltd. Meeting of creditors to be held at Room 43, Winchester Hse, Old Broad St, E.C.2, on 16 Dec., at 2.45 p.m.

Kendridge Ltd. Mr. R. A. Hawken, Bank Chambers, 1 John St, W.C.1, and Mr. G. A. Wade, Walter Hse, 418-422 Strand, W.C.2, appointed liquidators at extraordinary general meeting on 14 Nov. for the purpose of voluntarily winding-up.

Gould, Roberts and Co. Ltd. Mr. S. Chater, 35 Windsor Pl, Cardiff, appointed liquidator at extraordinary general meeting on 14 Nov. for the purpose of voluntarily winding-up.

Partnerships Dissolved

Northampton. Partnership between W. White and T. F. Cave, electrical engineers and contractors, carrying on business as T. F. Cave and Co., at 11 Marefair, Northampton, dissolved as from 30 Nov. All debts to be paid by T. F. Cave who is carrying on the business.

St. Mary Cray. Partnership between G. F. Smith and F. H. C. Bishop, radio, television and electrical installation engineers, carrying on business as Wellington Electrics, at 31 High St, St. Mary Cray, dissolved as from 1 Sept., 1959. All debts to be paid by F. H. C. Bishop, who is carrying on the business.

BANKRUPTCY ACTS

Receiving Orders

Leeds. J. W. McEvoy, electrical appliance dealer, carrying on business as Domestic Electrics at 246 Easterly Rd, Leeds 8. Receiving order dated 2 Dec.

Edmonton. L. Smith, electrical retailers, carrying on business as Smiths Electrics at 134 Chase Side, Enfield. Receiving order dated 24 Nov.

Public Examinations

Bradford. H. Rose, electrical wholesaler, carrying on business at 5 Carlisle Terr, Bradford 8. Public examination: 10.30 a.m., 20 Feb., at County Court, Manor Row, Bradford 1.

Croydon. T. Hall, electrical dealer, of 36 Homefield Rd, Old Coulsdon. Public Examination: 11 a.m., 16 Feb., at County Court, Scarbrook Rd, Croydon.

Manchester. E. Humphreys, electrical dealer, etc., formerly carrying on business in partnership as J. and H. Supplies at 466-468 Rochdale Rd, Harpurhey. Public examination: 10.30 a.m., 27 Jan, at Court Hse, Quay St, Manchester 3.

Sheffield. F. C. Turner, domestic appliance dealer, electrical and motor engineer, formerly carrying on business as Ross Electrics, Ross Eng. and as Eros Security, at 112 Sepulchre Gate, 14 Bentinck St, 28 Springwell La, Balby, 18 South Parade and Cherry La, Marshgate, all at Doncaster; and at 127 Hesse Rd and 127 Spring Bank, Hull, at 2 Green St, Huddersfield, and at 9 Eldon Terr, Leeds 1. Public examination: 2 p.m., 2 Feb., at County Court Hall, Bank St, Sheffield 1.

Bolton. Television Services, electrical equipment, sales and service engineers, of 8 Longsight Rd, Holcombe Brook, Bury. Public examination: 10.30 a.m., 1 Feb., at Court Hse, Mawdsley St, Bolton.

Newport. R. G. Fitzpatrick, domestic appliance retailer, formerly carrying on business as South Wales Vacuum Services, at 7 Westgate Chmbrs. Public examination: 10.30 a.m., 19 Jan., at Law Courts, Civic Centre, Newport, Mon.

Oxford. T. W. R. Last, electrical retailer, formerly carrying on business as Oxford Washing Machine, Vacuum Cleaner and Refrigeration Specialists, at 33 Cowley Rd. Public examination: 11.15 a.m., 16 Jan., at County Hall, New Rd, Oxford.

Wigan. D. Hodson, hardware and electrical dealer, carrying on business as Service, at 71 Shuttle St, Tyldesley. Public examination: 11 a.m., 13 Feb., at Court Hse, Crawford St, Wigan.

Applications for Discharge

High Court of Justice. J. C. A. Drew, electrical goods dealer, formerly carrying on business as K. Roberts Electrical, at 1-3 Oglander Rd, S.E.15. Application for discharge to be heard at Bankruptcy Bldg, Carey St, W.C.2, on 12 Jan., at 11 a.m.

Slough. D. MacIntyre, electrical engineer, of Flat 1, Mayfield, Bray Rd, Maidenhead. Application for discharge to be heard at Law Courts, Windsor Rd, Slough, on 18 Jan., at 10.30 a.m.

Wandsworth. C. D. Chappell, electrical engineer, etc., lately carrying on business as Chappell Bros. at 304 Balham High Rd, S.W.17. Application for discharge order made on 17 Oct.: discharged subject to certain conditions.

Dividend

Gt. Yarmouth. D. E. Pitchers, radio and electrical engineer, formerly carrying on business at 13 Tann La, Caister-on-Sea. Dividend per £: 1s 6d, payable at Official Receiver's Office, Norfolk Hse, Exchange St, Norwich, on 20 Dec.

Intended Dividend

Merthyr Tydfil. T. R. Thomas, electrical contractor, and E. Jones, television and radio engineer, carrying on business in partnership as T. R. Thomas and Co. at "Golden Key," Union St, Dowlais. Last day for receiving proofs for intended dividend: 16 Dec., to trustee: G. H. Down, 106 Walter Rd, Swansea.

Release of Trustee

Liverpool. G. Dickinson and K. G. Dickinson, electricians, carrying on business at 134 Clonsley La and 321 Church Rd, Havdock. Trustee: Henry S. Oliver, 5 Rumford Pl, Liverpool 3, released as from 24 Nov.

Appointment of Trustees

Bradford. P. W. Nelson, retailer and engineer, formerly carrying on business as S.R. Services at 551 and 543 Wakefield Rd and at 32 Town Gate, Wyke. Mr. R. W. Hellver, Brotherton Chambers, Westgate, Leeds 1, appointed trustee as from 21 Nov.

Chester. I. M. Robinson, radio, television and electrical dealer, carrying on business as Robinson's Radio, TV and Electrical Services, at 4 Down Hill, High St, Baglit, and 44 Castle St, Caerwre, Flint. Mr. R. P. Booth, 5 Rumford Pl, Chapel St, Liverpool 3, appointed trustee as from 21 Nov.

MEETINGS TO NOTE

THURSDAY, 15 DEC.

I.E.E. (Education Circle). Discussion: "How to Pass Examinations or the Psychology of Study." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Southern). Annual dinner and dance. The Polygon Hotel, Southampton.

I.E.E. (Irish). "Terminal Equipment for High Voltage D.C. Schemes." Professor C. T. G. Dillon. Physical Laboratory, Trinity College, Dublin. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Nuclear Energy Group). Discussion: "The Impact of a Three-Fuel Economy." Birdcage Walk, S.W.1. 6 p.m.

CHELMSFORD ENGINEERING SOCIETY. "The Genealogy of Remote Control." A. L. Hancock. Crompton's Social Hall. 7.30 p.m.

S. WALES INSTITUTE OF ENGINEERS. "Experiments in S. Wales with an Instrumented Coal Plough." L. Finkelstein. W. T. A. Morgans, C. D. Pomerooy and V. M. Thomas. Institute Bldgs, Park Pl, Cardiff. 6 p.m.

DIESEL ENGINEERS AND USERS' ASSOCIATION. "Report on Diesel Engine Working Costs and Performance 1955-60." Institute of Marine Engineers, 76 Mark La, E.C.3. 2.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (Southern). "Electronic Data Processing Allied to Production Engineering." F. W. Purchall. George Hotel, King St, Reading. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). Joint meeting with North Wales Metallurgical Society. "Instrumentation in Steelmaking." N. P. Bacon. Blossoms Hotel. 7 p.m.

A.S.E.E. (S. London Branch). "Management and Utilisation." Greyhound Hotel, High St, Croydon. 8 p.m.

FRIDAY, 16 DEC.

I.E.E. (Mersey and N. Wales). "The Log-motor—A Cylindrical Brushless Variable-Speed Induction Motor." Prof F. C. Williams, E. R.

Laithe, J. F. Eastham and L. S. Piggott. Town Hall, Chester. 6.30 p.m.

A.S.E.E. (Stoke and Crewe). "The Factories Act and the Electrical Engineer." G. L. Leighton. Grand Hotel, Hanley. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS. Presidential address: "The Development Engineer in the Petroleum Industry." E. S. Sellers. Pepys Hse, 14 Rochester Row, S.W.1. 7.30 p.m.

SATURDAY, 17 DEC.

A.S.E.E. GALA LADIES' NIGHT. Connaught Rooms, Gt. Queen St, W.C.2.

MONDAY, 19 DEC.

I.E.E. (Sheffield). Discussion: "Electrical Safety in Factories" and on "Electricity Supply Systems." Angel Hotel, Brigg. 7 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Steam Group). Discussion: "Safety on Construction Sites." Birdcage Walk, S.W.1. 6 p.m.

A.S.E.E. (Bristol and West). "Electricity in the Tobacco Industry." J. H. Quick. Grand Hotel, Bristol. 8 p.m.

TUESDAY, 20 DEC.

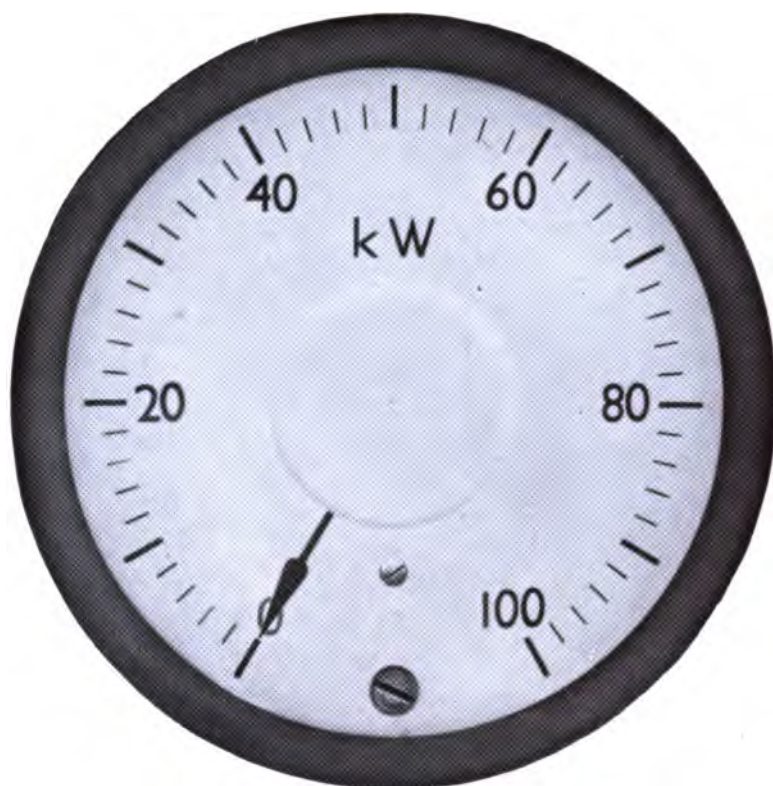
I.E.E. (Measurement and Control Section). Discussion: "Digital Transducers." Savoy Pl, W.C.2. 5.30 p.m.

A.S.E.E. "Electrical Control of Heating and Air-conditioning Plants." D. H. Powell. I.E.E. Lecture Theatre, Savoy Pl, W.C.2. 6.30 p.m.

WEDNESDAY, 21 DEC.

I.E.E. (Electronics and Communications Section). "Microminiaturisation." L. J. Ward. Savoy Pl, W.C.2. 5.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Kent). "Principles of Instrumentation." D. Mooney. King's Head Hotel, High St, Rochester. 7 p.m.



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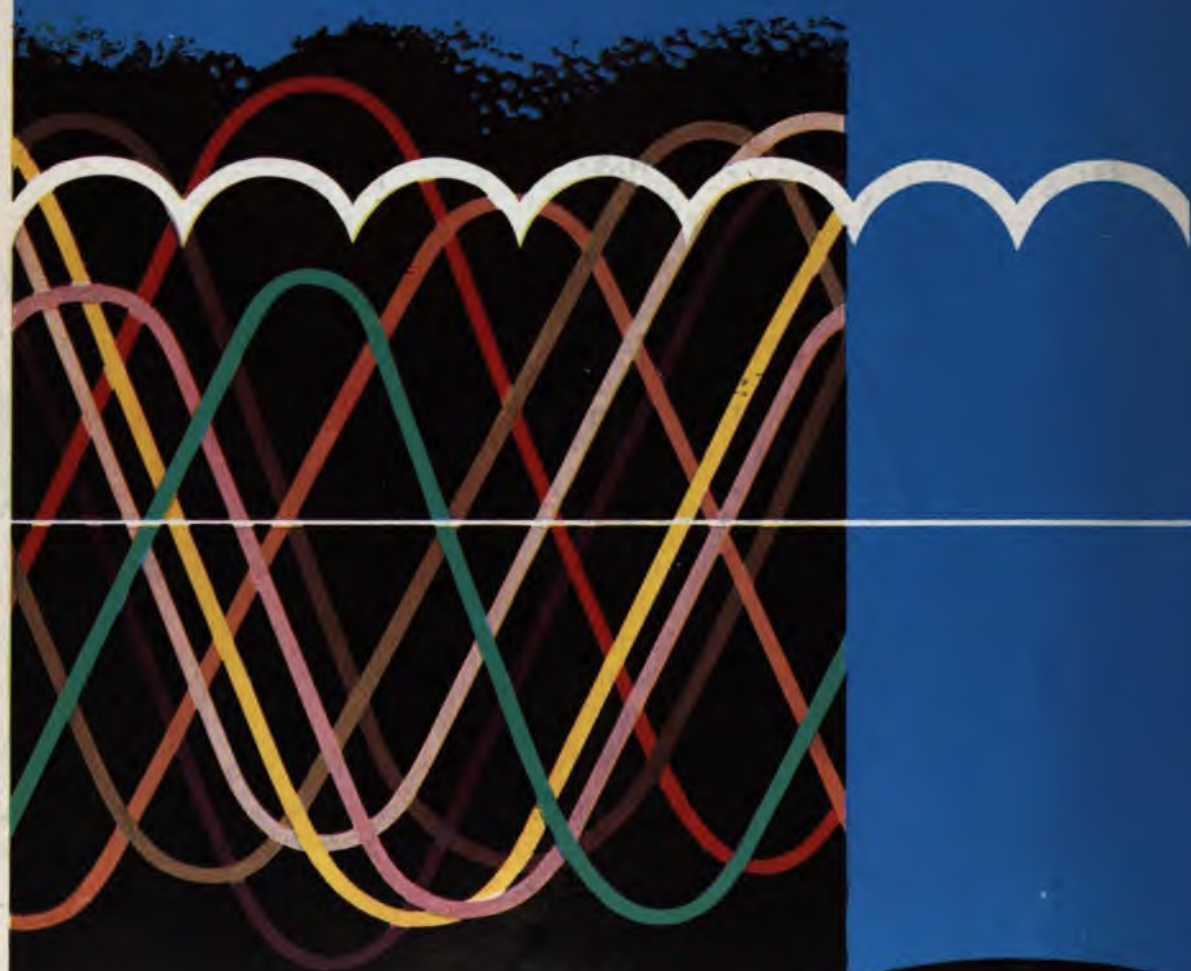
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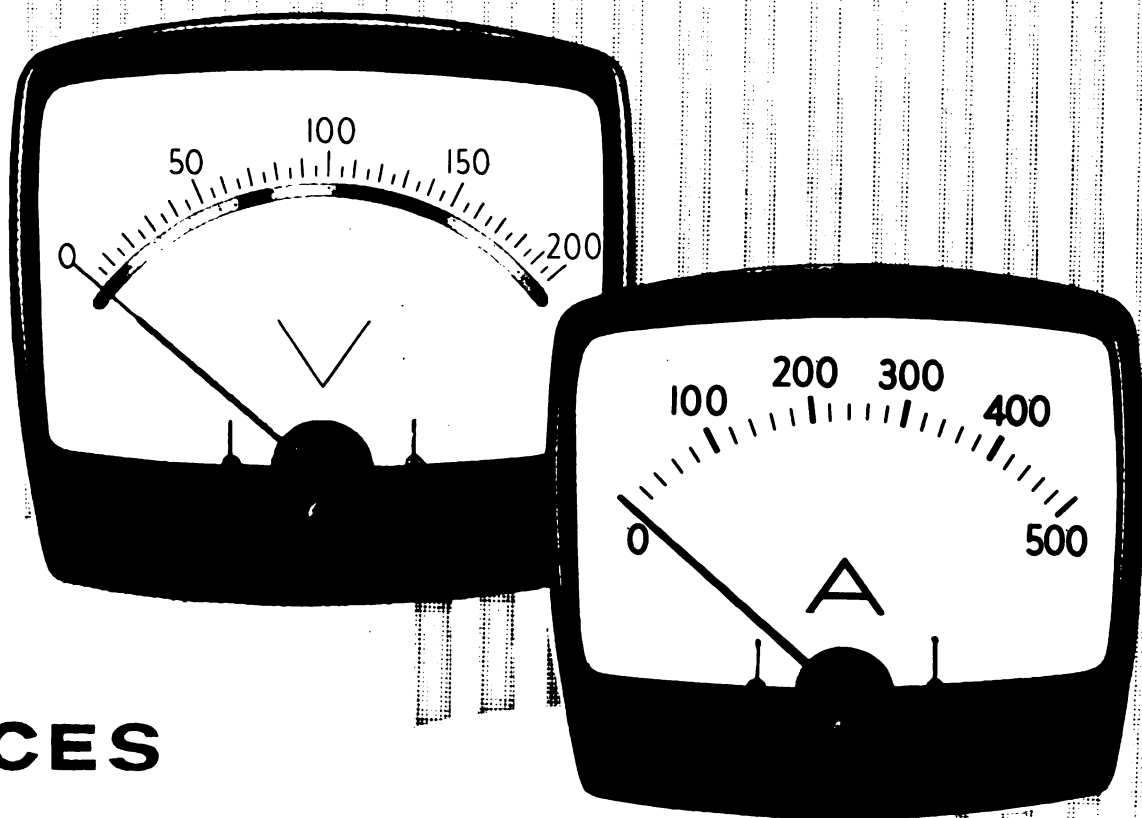
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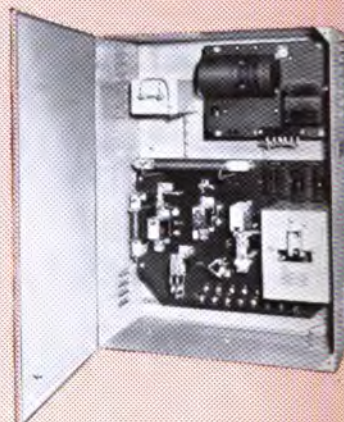
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s ce numéro

ours de Réseaux—3e Partie ... 951
 analyseurs de réseaux employés pour l'étude des
 nes des systèmes de distribution qui sont d'un
 re essentiellement local sont du type courant alter-
 impédance conjuguée. Ils opèrent des canalisations
 es de 50 Hz par l'entremise de stabilisateurs de
 , mais ils représentent les inductances par des
 sateurs, et des capacités par des inducteurs.
 ités standard ont été mises au point pour rep-
 r les génératrices, les impédances de lignes et les
 nces de charge. Il a été découvert, au cours des
 que la plupart des données mesurées étaient en
 s limites $\pm 1\%$ des valeurs calculées.

éristiques de Court-Circuit des Câbles ... 957

les câbles de systèmes de distribution, il est
 ire de spécifier une valeur de courant court-circuit
 isse être maintenue pour une courte durée, sans
 de dommages sérieux aux câbles ou joints associés.
 cherches effectuées au Royaume-Uni ont établi de
 es valeurs pour les types standards de câbles. Pour
 bles ayant une capacité maximum de 11 kV, des
 ont été établies à cause du dommage des joints,
 ar l'expansion thermique des conducteurs, domma-
 ines de plomb par la chaleur et, dans le cas des
 multiâmes, l'éclatement du câble par les forces
 liques.

pour l'Erection de Lignes ... 966

éthode généralement adoptée pour l'érection d'une
 érienne de transmission est l'emploi de portées
 lentes. Une autre alternative est d'effectuer une
 sur les conducteurs tout le long de la ligne, tension
 ente à celle de la ligne complète. Si cette seconde
 le est employée, il faudra vérifier soigneusement que
 ion de régime permise ne soit pas excédée incon-
 ent.

lieser Nummer

erwachungsgeräte, III ... 951

zur Untersuchung von örtlichen Versorgungsprob-
 verwendeten Netzüberwachungsgeräte haben kon-
 komplexe Wechselstromwiderstände. Obwohl sie
 Spannungsgleichhalter an 50 Hz Versorgungsnetze
 hlossen werden, verhalten sie sich induktiv gegen-
 ondensatoren und kapazitiv gegenüber Induktoren.
 nte Einheiten sind entwickelt worden, die jeweils
 storen, Leitungsimpedanzen und Belastungsimped-
 darstellen. Nachprüfungsergebnisse haben gezeigt,
 ie meisten mit diesen Geräten gewonnenen Mess-
 bis auf $\pm 1\%$ mit den errechneten Werten
 stimmen.

Kurzschlussleistung ... 957

Kabeln für Verteilungsnetze muss die kurzzeitige
 luss-Belastbarkeit des Kabels und der ange-
 enen Verbindungen angegeben werden. In Gross-
 ien durchgeführte Forschungsarbeiten haben zur
 lung neuer Kennwerte für genormte Kabeltypen
 t. Bei Kabeln mit einer Belastbarkeit bis zu 11 KV
 ie durch die Wärmeausdehnung der Leiter verur-
 Beschädigung der Verbindungen einen begrenzten
 ktor dar. Weitere begrenzende Faktoren sind die
 Beschädigung von Bleiumhüllungen und bei Mehr-
 terkabeln das Sprengen des Kabels durch magnet-
 Kräfte.

rechnen von Freileitungen ... 966

übliche Methode der Freileitungserrechnung ist auf
 des Begriffs der sogenannten "Ersatzspannweiten".
 falls werden Leiter auf der ganzen Strecke im
 g mit der Spannung der vollausgeführten Leitung
 ht und in diesem Falle ergibt sich die Notwendig-
 t daraufhin zu prüfen, dass die zulässige Betriebs-
 ng nicht unwissentlich überschritten wird.

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Cables Under Short-circuit Stress ... 957

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ELECTRICAL TIMES

ESTABLISHED 1891

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Comment



We wish our readers a Merry Christmas and a Happy New Year



CABLE FAULT CAPACITY

How much copper needs to be put into a distribution circuit may be determined by fault current rather than load current. This is becoming increasingly a factor to be considered in distribution system planning, and two papers presented to the IEE last week provided the industry with an important addition to reliable information on this question. For example, as loads become larger, distribution engineers are finding it difficult to keep within the accepted 150 MVA limits on 11 kV feeders. Switchgear manufacturers can manage 250 MVA without difficulty; but what will happen to cable networks if corresponding currents are imposed? MEB chief engineer Mr G. Buckingham, in a practice-packed paper extending to day-to-day engineering the research results of the ERA, painted some frightening pictures of burst sheaths and wrecked joints if safe limits were exceeded; but he was reassuring to the extent that the newly established short-time fault-current carrying capacities are in most cases more generous than those to which distribution engineers should have been working in recent years. It is reassuring, too, to consider that the risk of finding too much copper uneconomic is limited in the present fast-growing demand situation. Overall, however, it seems that just as the cable engineer has got used to designing dielectric whose thickness is determined more by switching and atmospheric over-voltages than by system working voltage, so must he become more accustomed to basing copper cross-section on fault currents rather than load currents. Establishment of the new safe values for copper, lead and conventional joints will make engineers impatient for the promised extension to deal with aluminium and mechanical connections.

SOUTH COAST GENERATION

What factors are to determine generation costs for central southern England? The question is raised by the CEGB's rather ambiguous statement, issued last week, that they are not going to press at present for consent to build a nuclear station at Hamstead, on the Isle of Wight. This decision has been reached because of concern about the amenity angle; technically, Hamstead has been found "excellent" for a Magnox-type nuclear station (despite the submarine cable link that would be involved), while the Sussex alternative previously advanced, Earnley, has been found unsuitable for any foreseeable type of nuclear station. But having decided

against proceeding with the Hamstead site immediately, the Board seem to have no alternative policy. Their statement merely rehearses the difficulties. To generate in the Midlands would be possible but would mean more (and unpopular) transmission lines; and more stations for the Midlands, where they are as unwelcome rurally as in the south. To put a conventional station on Southampton Water would be feasible, but the high fuel cost makes it economically questionable, if oil is considered politically unacceptable. Between Dungeness and Weymouth the south coast has no potential sites for Magnox reactor nuclear stations that even satisfy preliminary requirements. How to cut this Gordian knot while southern county power demand goes on increasing at a rate faster than the national average? Perhaps the answer lies in development of more advanced types of nuclear stations, particularly the advanced gas-cooled reactor. Sir Robertson King estimated last summer that not more than nine stations are likely to be built by the CEBG of the Magnox reactor type. The recently announced Wylfa will be the eighth. Advanced gas-cooled reactor stations might face less severe siting requirements than current nuclear designs and so be a possibility on the south coast. In that case the CEBG delay in decision might mean that Hamstead could be left in peace without the electricity consumers of the Southern Electricity Board having to pay heavily for it through the operation of the bulk supply tariff. The only feasible alternative would seem oil, despite the opposition mining-area-MPs would advance. In the short-run, that may be the most practical solution.

INSULATION LIFE

Most engineers have a rough idea that an increase in temperature of about 10°C will halve the life expectancy of electrical insulation, the exact value of the ratio depending on the class of insulation involved. They are not so likely to be conscious, however, of the extent to which the relationship is affected by the varying temperatures that accompany cyclic loading and short-time overload. A paper by Dr J. Ben Uri in the somewhat recherché Part C of the *IEE Proceedings* makes this point with some force, through calculations based on experimental work which is at the basis of the halve-per-ten degrees rule. It is not only the relatively short time at the highest temperature that acts to reduce life, it is the relative slowness of the return to nominal temperature. As a result, average temperatures, usually considered in applications of the insulation life rule, give results of life expectancy well in excess of what strict application of a temperature-time summation shows. This situation would be the more worrying if there were any widespread experience of premature breakdown of insulation due to designers working to average temperatures without making sufficient allowance for short-time overloads. Such trouble is not prevalent, a situation which Dr

Ben Uri attributes to relatively low permitted temperatures having been allocated to the various classes of insulation. In this respect, the present generation of engineers are not the first to have benefited from a built-in factor of safety.

TROUBLE ON THE LINE

Faults serious enough to cause substantial numbers of trains to be taken out of service have dogged two of the most recent rail electrification schemes. Those on the Eastern Region appear susceptible to relatively easy rectification; in Scotland, the faults were accompanied by a serious accident, and, to judge by preliminary reports, are likely to involve a more time-consuming modification. There can be no denying the seriousness of these developments to the hopes built round the 25 kV, 50 c/s electrification system developed in Britain. Because the Scottish incident is to be the subject of a statutory inquiry, it is difficult to comment on precise technical details, although the significance of the transformers being involved will not be missed. What is necessary now is the fullest public account, at the right time, of the engineering explanation for the troubles, so that the extent may be defined to which they are peculiar to the British system of two-voltage working and limited clearances, and the completeness of the cure made evident. A situation such as this, involving more than one great manufacturing concern in the electrical industry, can be retrieved only by frankness. The 25 kV, 50 c/s system is a pioneering concept in many ways, and trouble is common enough in such cases, as the aircraft industry, for example, knows well.

SUCCESSOR TO O.E.E.C.

Formal signing of the documents which next year will bring into being an Organisation for Economic Co-operation and Development marks a pause rather than an end in the work of the Organisation for European Economic Development, which body it will replace. The principal difference between the new Organisation and the old is that it will explicitly include Canada and the USA, so essential to any consideration of Europe's trading problems, rather than have them present in observing capacities. Many of the committees of OEEC are to continue their work largely undisturbed, so continuance can be hoped for of the valuable series of statistics which have come from this quarter, as well as for some of the annual surveys, and the occasional special studies which have helped so much in the overall evaluation of power policy in Europe. Achievements of OEEC in its 12 years' existence includes much for which those who have worked for it can be proud, nowhere more than in relation to the electricity industry. Building on such a tradition of usefulness and of progress in practical things without undue political interference, the OECD, as we must learn to write this old/new body, must have high hopes of success.

Meteor

Network analyser installations

REGIONAL, DIVISIONAL AND AREA BOARD ANALYSERS

PART 3

by A. W. Hales,* A.C.T.(B'ham), A.M.I.E.E., A.M.Brit.I.R.E.

THE two preceding articles of this series related to the network analyser installation at the Central Electricity Generating Board's headquarters. This third (concluding) article deals with a.c. network analyser installations of a type developed by the Board's headquarters, and which is in use in various regional, divisional and area board headquarters throughout the country.

These analysers are intended more specifically for the study of problems of an essentially local character. The necessity for the provision of such equipment was motivated principally by the increasing complexity of power systems at all voltages and the number of problems were being encountered requiring solution on an a.c. network analyser. Thus, there arose a significant demand on system design engineers to have their own analytical equipment immediately available.

A working party of the then Central Electricity Authority and the electricity boards was given the responsibility of conducting an investigation into the feasibility of making available a.c. network analysers which, whilst having the same operational facilities, were of low initial cost. The working party, after carrying out a review of past and present activities in the sphere of network analyser design and construction, decided that to proceed with the development of an equipment based on then-existing designs would, of necessity, be expensive, and furthermore, it would be difficult to meet the desired specification. The specification required that the following conditions be met, consistent with economic production:

- The equipment should require minimum accommodation space.
- It should initially be of a completely "universal" design, readily adaptable, and lend itself in individual circumstances to the addition of an economic "geographical" extension.
- It should require the minimum maintenance and be capable of a consistent high level of operational performance without the necessity for frequent specialist maintenance and checking.
- The main network instrumentation should be such that it could be calibrated and checked from time to time without recourse to the facilities normally existing in the meter test laboratories of the divisions or area boards.
- The analyser should utilise for its working excitation a supply derived directly from the 50 c/s mains, thus eliminating the necessity of providing a separate oscillator and ancillary amplifying equipment.
- The components used in the sectional units should be readily replaceable and present no replacement difficulties during the anticipated life of the equipment; neither should they possess critical tolerance values.

(g) The mean overall accuracy of the analyser when applied to system problems for which rigorously calculated solutions are available should be better than $\pm 2\%$ at nominal frequency. The measuring equipment, when considered as a separate entity, should have an overall accuracy of better than $\pm 1\%$.

(h) The equipment should be applicable to steady-state a.c. power-system studies and synchronous-machine transient-stability studies effected by the step-by-step method.

With this specification as an objective, work on the design and development of a prototype equipment was initiated and subsequently satisfactorily concluded. The design of the production equipments, of which there are now many in operation, was largely based on experience gained from work on the prototype, though there is little similarity between the two categories of equipment.

Some Design Considerations

The direct-impedance type of analyser, when investigated, was found to be unattractive both from the economic, component dimension and supply viewpoints, more particularly when operating at the mains frequency of 50 c/s. A review of possible alternative types of analyser and their respective operational and economic merits was undertaken and it was concluded that the conjugate-impedance analyser showed the most promise as a type on which to

* Mr Hales is with CEGB headquarters. Previous parts of this article appeared on 3 November (p. 667) and 24 November (p. 797). The installations described are the subject of an IEE paper detailed in Reference 1 of Part I.

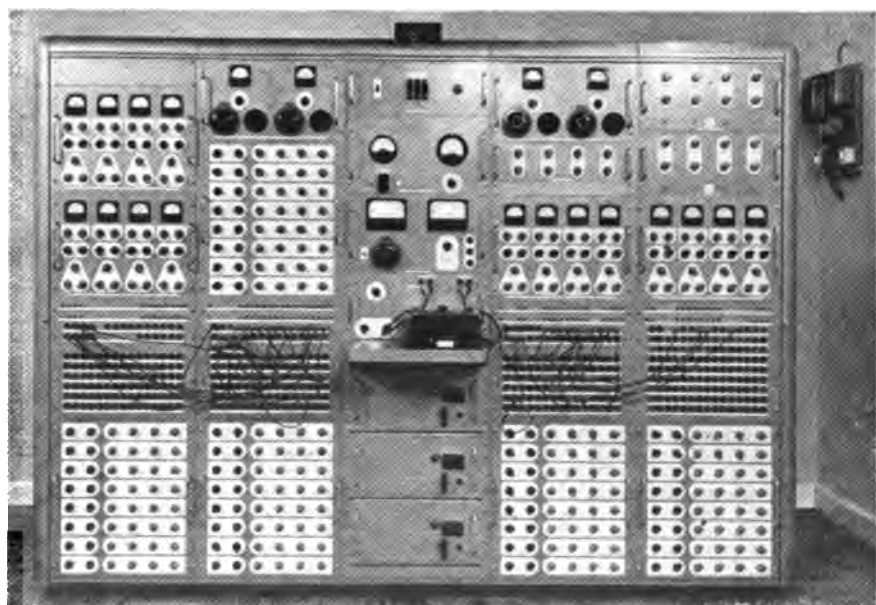


Fig. 10. 50 c/s conjugate-impedance a.c. network analyser installed at the headquarters of the Eastern Electricity Board

base future development work. Accordingly, design and development work on such an analyser—operating directly from the 50 c/s mains supply—was commenced. An analyser, based on this principle, although operating at 120 c/s, has been described elsewhere,* but it is significantly different from the one which is the subject of this article.

The chief differences other than of a constructional nature are as follows:

- (a) The use of feedback amplifiers in the generator units is dispensed with.
- (b) The metering equipment is designed to enable all measurements to be made with one main instrument, which replaces, functionally, four separate instruments.
- (c) The base current and power values employed are half those previously used, while the base frequency of 50 c/s has rendered mains-frequency conversion equipment unnecessary.

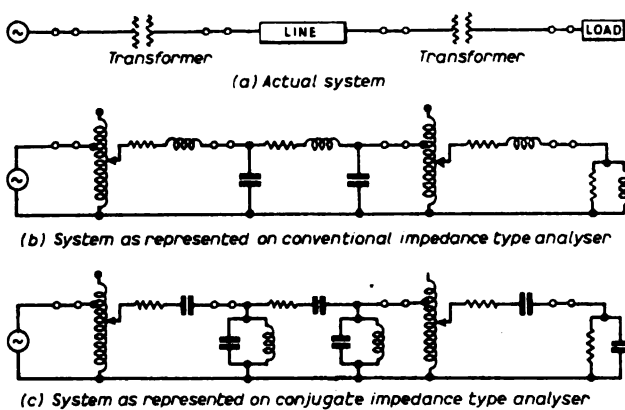


Fig. 11. Representation of power system on conjugate-impedance and conventional a.c. network analyser

The representation of a typical system using the conjugate-impedance principle as distinct from the more conventional direct-impedance principle is shown in Fig. 11. In order to minimise costs, it was decided that uncalibrated network impedance elements should be employed, since this would permit the incorporation of readily available commercial wide-tolerance components, and also simplify subsequent maintenance.

The base operating quantities of the analyser were selected after consideration of the outline design of the various standard units, from which the analyser would be ultimately constructed. Some factors requiring consideration at this initial stage were, for example, the availability of preferred sizes of capacitor and associated tolerance limits, and the operating conditions of the Magslip transmitters which were proposed for use in the generator units. The outline design of metering equipment and the inevitable stray losses which could be expected in the analyser network indicated that it would be imprudent to use a base current of less than 5 mA. After consideration of the many conflicting factors involved, the following compromise base values were adopted:

Voltage.....	50 V	Power.....	250 mVA
Current.....	5 mA	Admittance....	100 micromhos
Impedance.....	10 kilohms (C=0.318μF)	Frequency.....	50 c/s

Subsequent developments have indicated that the power base of 250 mVA could be further reduced now that transformer core material having improved loss characteristics is available. Against this, however, it must be

remembered that the residual output of the amplifiers associated with the metering system is predominantly of mains frequency, and a reduction in power and current base would necessitate a more stringent specification for these amplifiers. Operational experience with the numerous analysers already in operation has indicated that no radical change in base operating quantities is either necessary or desirable.

The equipment is ordinarily constructed from basic standard units and is completely universal in its application to system problems. It can, however, be used in conjunction with a geographical network layout if desired without adding complex and consequently expensive ancillary equipment. There has, however, as yet been no requirement for the development of such a feature. This doubtless follows from the ease with which the analyser can be operated when used as a completely universal equipment.

General Description of Equipment

The arrangement and extent of a typical medium-sized installation is shown in Fig. 10. This indicates the disposition of standard units which is generally adopted for most equipments. Essentially, each analyser consists of a central common equipment rack comprising mains power supply equipment, mains voltage stabilisers, main metering equipment and impedance calibration equipment, adjacent to which are located the various functional units of the analyser, i.e., interconnection panel assemblies, generator units, load impedance units, auto-transformer units and shunt-susceptance units.

The facilities and ranges afforded by these units are shown in Table 3.

Generator Units

Generator units provide sources of e.m.f. for exciting the analyser network and are independently variable in respect of both phase and voltage. They comprise a Magslip transmitter/variable-ratio transformer combination. The former are supplied direct from a 3-phase 50 V 50 c/s stabilised supply system. Output voltage of the unit is monitored by a voltmeter calibrated 0—1.5 per unit volts and fitted with a red index pointer. The Magslip rotor assembly is driven via a slow-motion dial having drive ratios of 50:1 and 1:1, respectively. Being fitted with a vernier scale, it permits an angular resolution of 0.1° to be obtained. The output impedance of a unit when adjusted for 1.00 per unit terminal voltage is approximately 0.007+j0.002 per unit.

Load-impedance Units

Load-impedance units, which are used for the representation of real and reactive (lagging) loads, consist of switched parallel branches of resistance and capacitance, all of which are supplied from the secondary of a variable ratio auto-transformer. Details of the ranges are contained in Table 3. All resistance and capacitance ranges have their setting positions identifiable, thus permitting the speedy calibration of the units by reference to calibration charts. The setting of a particular unit can be recorded in those cases where the possibility of repetitive studies exists.

Line-impedance Units

These units comprise ranges of series connected variable resistance and capacitance. The normal operational impedance range is as shown in Table 3, but owing to the inverse relationship between capacitance and reactance the upper reactance setting is in practice well in excess of

* Kimbark, E. W., Starr, J. H., and Van Ness, J. E.: "A Compact, Inexpensive, A.C. Network Analyser," *Transactions of the American IEE*, 1952, 71, Part 1, p. 122.

nd limited only by considerations of calibration
tion. The lowest reactance setting—which is
the total value of capacitance obtainable—is
largely by economic considerations. The lowest
linarily employed in standard units is about
nit, which corresponds to a total capacitance of
4F, though such a unit can be readily modified
mum setting of 0.015 per unit. All resistor and
omponents used in these units, with the excep-
e potentiometers, are of ±10% tolerance, the
being of the tubular paper type. The com-
capacitors for an individual unit is as follows:

Range I:	9×1.000 μF=9.000 μF
Range II:	9×0.100 μF=0.900 μF
Range III:	9×0.010 μF=0.090 μF
Range IV:	5×0.002 μF=0.010 μF
Total	10.000 μF

resentation of various transmission line equiva-
its is achieved by using the standard line
units in association with shunt-susceptance units
n), the necessary connections and metering
nts being effected on the interconnection panels.
ferred methods of interconnection have been
and, in fact, used.

l switch-positions on the units are identifiable,
proximation to the desired calibration can be
eference to a typical calibration chart.

nsformer Units

onsist essentially of an auto-transformer together
iated ratio-change switching facilities. When it
to represent the series impedance of a trans-
unit is used in association with a line-impedance
winding arrangement employed gives a voltage
of ±0.20 per unit voltage in 0.01 unit increments.
ieved by having three main sections of winding,
0 per unit section, one 4×0.04 per unit section
4×0.01 per unit section, the ratio adjustment
cted by variation in tap selection and winding
ach sectionalised winding.

l is used as core material, the typical total loss
lying nominal full load (i.e., 250 mVA at unity
tor from the high-voltage winding with a ratio
being approximately 0.015 per unit. Approxi-
0.015 per unit of this is attributable to winding
ss. The magnetising component of the no-load
is compensated, at unity ratio, by the inclusion
pF capacitor in parallel with the main 1.0 per
ge winding. The equivalent leakage impedance
sformers is 0.0017+j0.00046 per unit impedance
5+j0.0009 per unit impedance for the maximum
buck conditions, respectively.

sceptance Units

to the practical and economic difficulties associ-
the manufacture of a near-pure inductance for
ation, the alternative of a parallel LC circuit is
his instance the inductance has one tapping, thus
two values of inductance, 430 Henrys and 172
espectively. The associated capacitance range is
by banks of switched moulded mica-type
which are selected by 18-position switches. The
acitance range is nominally from zero to
, thus giving an overall range of susceptance for
el combination of 0.03–0.19 per unit. The

Table 3. Standard Functional Unit Ranges

Type of Unit	Ranges
Generator ...	Output Voltage - 0 -1.50 p.u. Phase - - - 0 -360° Power output - 0 -10.0 p.u.
Load Impedance ...	Real Power - - 0 -2.00 p.u. } at 1.0 p.u. Reactive Power - 0 -1.20 p.u. } voltage Auto-transformer Ratio 1.0-80-1.20 (in 0.01 steps)
Line Impedance ...	Resistance - - 0.00-0.56 p.u. Reactance - - 0.03-1.00 p.u.
Auto-Transformer	Voltage Ratio -1 : 0.80-1.20 (in 0.01 steps) Series impedance-As for line impedance unit
Shunt Susceptance	Susceptance - -0.03-0.19 p.u. (at 1.0 p.u. voltage)

inductance is wound on a Ferroxcube core and has a
Q-factor of approximately 25 as determined by bridge
measurement. The normal operating range on this basis
is in the region Q=25 to 8, the latter being considered
the minimum value consistent with adequate accuracy of
representation. Variations in nominal setting with changes
in line-to-neutral voltage do not exceed approximately
0.08% in the voltage range 0–1.2 per unit. The range of
susceptance can be varied as also can the Q-value by
suitable selection of L and C values and by modification
of the inductance design. As far as the Q-values are con-
cerned, the matter is essentially one of compromise between
desired Q-value and cost.

Main Metering Equipment

A functional schematic of the main metering system is
shown in Fig. 12. It performs the dual functions of net-
work impedance calibration and measurement in the
analyser network, the former when used in association
with the impedance calibration equipment. As will be seen
from the diagram, it consists essentially of two separate
amplifier channels, one each for the current and voltage
circuits, respectively, together with associated stabilised
power-supply units and a single indicating instrument. The
facilities provided enable the following quantities to be
measured:

- Voltage
- Current
- Real power
- Reactive power
- Relative voltage phase angles {In conjunction with variable-phase
- Relative current phase angles {impedance calibration source.
- Resistance
- Reactance {In conjunction with variable-output-voltage im-
- Conductance {pedance calibration source.
- Susceptance

The range of voltage and current measurement provided
are shown in Table 4.

The design of the amplifier channels follows conven-
tional practice, negative feedback of both the voltage and
current types being employed. The current channel com-
prises a two-stage pre-amplifier having overall negative
voltage feedback and a two-stage output amplifier having

Table 4. Voltage and Current Ranges

Quantity	Range	Per unit value for f.s.d.	Scale Multiplier	Actual reading for f.s.d. Volts	mA
Voltage ...	1	0.250	0.20	12.50	—
	2	0.625	0.50	31.25	—
	3	1.250	1.00	62.50	—
	4	2.500	2.00	125.00	—
Current ...	1	0.250	0.20	—	1.250
	2	0.625	0.50	—	3.125
	3	1.250	1.00	—	6.250
	4	2.500	2.00	—	12.500
	5	6.250	5.00	—	31.250

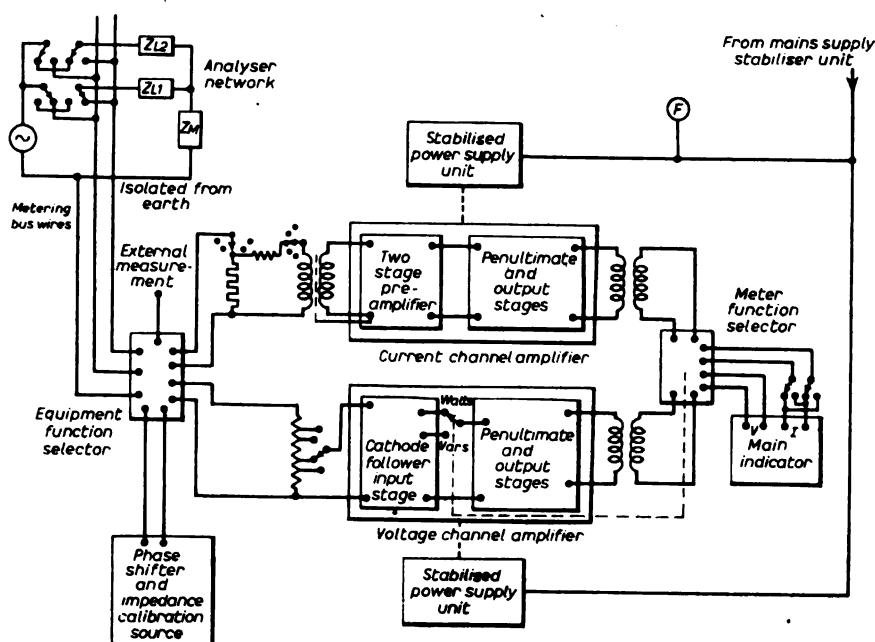


Fig. 12. Schematic diagram of functional layout for metering system of a 50 c/s a.c. network analyser

connection of the main indicating instrument to the two amplifier channels is performed automatically by a function-selector switch which determines the quantity being measured, i.e., voltage, current, real or reactive power.

The use of negative current feedback in the output stages, with a consequential high output impedance, minimises the errors in measurement introduced by the finite value of mutual inductance which exists between the fixed and moving systems of the main dynamometer indicator and also obviates the necessity for using high stability close-tolerance components in the load-impedance circuits of each channel. The operating current for full-scale deflection

of 100 mA r.m.s. gives a reasonable compromise between considerations of economic output-stage design and an adequate torque/weight ratio for the moving system of the dynamometer indicator.

Each amplifier channel is supplied from a separate stabilised power-supply unit of conventional design, thus minimising any possible interaction between the two channels by virtue of a common supply-source impedance. Valve monitoring facilities are incorporated in the unit, as also is a mains-frequency meter, so that a continuous indication of operating conditions is available. Ordinarily, frequency deviations in excess of ± 0.2 c/s rarely obtain.

The performance of the metering equipment when measuring real or reactive power is affected to some extent by variations in mains-frequency. However, with a ± 0.2 c/s frequency deviation the changes in real power indication are insignificantly small, whilst the reactive power indications are within $\pm 0.25\%$ of nominal.

overall negative current feedback. The input stage of the pre-amplifier derives its input via a unity ratio transformer from the voltage drop produced across a precision shunt which is inserted in the analyser network at the selected point of measurement. The insertion effect of the shunt is negligibly small, being equivalent to an additional 0.001 per unit impedance connected in series with the network. The input transformer, which has a negligible shunting effect on the shunt, is both electrostatically and electromagnetically screened. Changes in current range are effected by the selection of differing values of shunt, a voltage drop of 12.5 mV r.m.s. corresponding to full-scale deflection on the main instrument (100 mA r.m.s.). The primary circuit of the input transformer forms a bridge network which enables an approximate balance of the primary-secondary capacitance currents in the primary winding to be obtained. This ensures that the primary-secondary capacitance current does not contribute effectively to the output of the channel. The negative current feedback applied over the output amplifier stages gives an output impedance of approximately 900 kilohms, and when the channel is delivering maximum rated output the total harmonic distortion introduced by the channel is not greater than 1.0%, while the total hum and noise level is not greater than 0.1% of the current corresponding to full-scale deflection, i.e., 100 mA r.m.s. The linearity between input and output is within 0.2% of the output for full-scale deflection in the range 50% to 100% output current.

The voltage-channel amplifier derives its input from a resistance voltage-divider network connected between the line and neutral of the analyser network. The insertion effect of the divider is again negligibly small and at 1.0 per unit voltage corresponds to a current drain of 0.002 per unit. The input voltage for maximum output current (100 mA r.m.s.) is 12.5 V r.m.s. The input is fed to a cathode-follower stage from which two alternative outputs differing in phase by 90° are available, selection being dependent upon whether it is desired to measure real or reactive power. The output and penultimate stages of the voltage-amplifier are identical in all respects to those of the current amplifier channel, and the performance of the channel in respect of linearity, hum and noise level, etc., is equal to or better than that of the current channel. The

Calibration of Main Metering Equipment

The metering equipment is designed so that its calibration may be undertaken in a meter laboratory appropriately equipped to meet the requirements commonly encountered in the electricity supply industry. The main indicator calibration can be determined with a d.c. potentiometer and thereafter it can be used as a d.c./a.c. transfer instrument. All that is required in addition to this verification is the availability of a precision-grade voltmeter having known correction factors, and a range of precision-grade resistive and capacitive load-impedance units. With these facilities and adherence to a standard sequential procedure for calibration the equipment will give a consistent high accuracy performance over long periods of time.

Impedance-calibration Feature

Since the shunt and series impedance elements of the analyser network are uncalibrated, provision has to be made for their individual calibration as circumstances demand. Ordinarily, the shunt elements are calibrated with 1.0 unit voltage across their terminals whilst the series elements are calibrated with a 1.0 per unit current flowing through them. The measurement and correlation of real and reactive power dissipation in the network elements

ives, to some scale, the actual resistive and reactive
nce, respectively, of the network elements. The
nce calibration source is a Magslip transmitter unit
same type as used in the generator units. When
r impedance calibration its three-phase stator wind-
energised on two phases only and with rotation its
ircuit thus constitutes a source of variable e.m.f.
easurement of real and reactive power is carried out
main metering equipment, which is used in associa-
ith the impedance calibration unit. Separate instru-
are provided for the measurement of voltage across
elements and current through series elements whilst
calibrated so as to avoid unnecessarily frequent
on of meter function. Incorporated in this unit is a
selector switch which determines the function of
ain metering equipment. The six facilities available
follows:

ant-impedance calibration	Using variable-voltage con- stant-phase impedance-cali- bration source.
ies-impedance calibration	
etwork measurement.	
lative voltage phase-angles	Using variable-phase con- stant-voltage impedance- calibration source.
lative current phase-angles	
ternal measurement.	

ill be noted that (f) above enables the metering
nent to be used in an isolated condition, thus pro-
a useful self-contained precision metering equipment
oratory use.

chief use of the impedance calibration equipment
the final trimming of unit calibrations before putting
into operational use. An extensive range of typical
ition charts covering all types of unit is provided.
ise of these charts reduces significantly the time
ed for calibration.

r Supplies

three-phase 50 c/s mains supplies are fed to three
nnected voltage stabiliser units which ensure that
riations in mains supply voltage are reduced to an
able level, thus permitting the continuous operation
analyser. In order to minimise the effects of har-
s already present in the supply, a regulator of the
operated variable-ratio booster transformer type is
yed. The r.m.s. output available is stabilised to
 $\pm 0.25\%$ under the following operating conditions:
put voltage -17.5 to +8.75%
oad Current 0-9 A
oad power factor .. 0-1 (lagging or leading)
requency 45-65 c/s
emperature variation From normal ambient up
to 20°C.

speed of response of the regulators for small
e deviations, e.g., ± 3 V is equivalent to about 12.5
of the supply frequency, whilst for deviations in
of this a response of 0.15 V/sec is achieved.

NTRACTORS ASSOCIATED WITH THE 50 c/s A.C. NETWORK ANALYSER PROJECT	
list of the principal contractors associated with these ipments is given below :	
sh & Thompson Ltd.	Functional unit manufacture and overall installation.
ed Imhof Ltd. ...	Rack and chassis assemblies.
ord Electrical In- ruments Ltd. ...	Panel instruments for generator and load units.
gamo Weston Ltd.	Main indicator and impedance calibration instruments.
romex Controls Ltd.	Mains voltage stabilisers.

A separate unit provides 3-phase 3-wire 50 c/s 50 V
supplies for the generator and impedance calibration unit
Magslip transmitters. It consists of three single-phase
transformers, each of 150 VA rating, with both primary
and secondary windings connected in star, this rating being
adequate for ten generator units and one impedance cali-
bration unit. Mains isolating equipment and protective
fuses are also incorporated.

Termination and Interconnection Fields

The various functional elements of the analyser are
mounted in enclosed racks, each of which contains a
termination and interconnection field assembly situated in
a standard position. The fields normally:

- (a) Serve as a central termination field for the func-
tional units within a rack.
- (b) Accommodate the circuit selector switches used
to insert the main metering equipment in the functional
units within the rack.
- (c) Enable functional units to be assembled to repre-
sent a network which it is desired to study.
- (d) Permit direct connection to the impedance cali-
bration equipment located in the common equipment
rack and the main analyser neutral busbar.

The rear of each field is used for carrying the various
supply bus wires, etc., throughout the length of the equip-
ment. By this means, rearrangement of an existing
analyser or its future extension can be effected without
recourse to major internal modification.

Operational Performance of Equipment

In order to gauge the performance of the analyser, a
range of typical power system problems was solved, each
having a known solution. It is sufficient to indicate that
the bulk of the measured data was within $\pm 1\%$ of the
calculated values, whilst all were within $\pm 2\%$ of the
calculated values.

It was known, however, that inevitable minor physical
imperfections in the analyser network contributed in vary-
ing degrees to the errors obtained. The most important
contributory factors in this respect are:

- (a) The presence of stray line-to-neutral capacitance
in the line-impedance units.
- (b) The finite, though small, residual output of the
current channel amplifier.
- (c) Slight unbalance of the input bridge network of
the current-channel amplifier.
- (d) The inevitable fact that the main metering equip-
ment does not possess nominal zero error under some
or all conditions of measurement.

A considerable fund of operating experience with the
many equipments now in service has been accumulated
and the adequacy, reliability and performance of the
equipments have amply justified the choice and design of
analyser equipment. Doubtless, the application of the
analyser will be extended with the passage of time by the
introduction of additional functional units, and there is
every indication that the number of equipments will con-
tinue to increase as their potentialities become more widely
known and exploited.

Acknowledgments

The author wishes to thank the Chief Transmission
Engineer of the Central Electricity Generating Board for
permission to publish this series of articles and to use the
information on which it is based. He also wishes to thank
the Chief Engineer of the Eastern Electricity Board for
permission to use the Board's equipment for illustration
purposes.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Heating in Canada

RESISTANCE heating for homes is quite rare in North America. Your readers may be interested in results obtained here in Victoria, Canada. The installation covers a bungalow of 1,350 sq ft, 10,000 cu ft space with seven rooms. Each room has its individual heater and thermostat control. The heaters are convector type, baseboard mounting and are 7 in. high by 3 in. deep, and vary in length from 4 ft to 10 ft, according to the loading of 1 kW to 2.75 kW.

Victoria is in the same latitude as Paris, but has a mild, cool climate similar to that of Northern Ireland. Some heating is required for 11 months out of the 12.

Except in the bedrooms, which are left cool, the thermostats are set at between 70° and 75° F. This is a little low even for the coastal area, and very low compared with other parts of America where the room temperatures are commonly maintained at between 80° and 85° F.

Hot water is from a 2 kW immersion unit, and there is the usual range, refrigerator, etc. The room heaters total 13.75 kW.

During the past year, the maximum demand was 11 kW; kWh consumed 24,500; cost \$399.71; cost per kWh 1.63 cents.

The rate schedule is too complicated to explain in this letter, but is based on a penalising rate for the six colder months, so that a certain number of kWh/kW of demand are paid for at a higher rate. The result is that the monthly kWh rate has varied between 1.59 and 1.90 cents per kWh.

The above cost is probably about \$70.00 a year higher than a combination of electricity for domestic purposes and oil space heating. Oil heating leaves a tarry deposit in the chimney which has to be cleaned out periodically, and a certain amount eventually gets into the house as well, so perhaps all told there is little in ultimate cost.

J. P. Thornton,

VICTORIA B.C., CANADA.

Generation by Free-piston Engines

IN the article "Generation by free-piston engines" on page 843 of the ELECTRICAL TIMES, 1 December, it is stated that free-piston engines manufactured by the National Gas and Oil Company are in use for electrical generation in installations ranging from a single 6,000 kW unit to a power station producing 36 MW. This is a serious error of fact. The only 36 MW free-piston power station in the world, in use at present, is at St. James Power Station, Singapore. There are no gasifiers or free-piston engines manufactured by the National Gas and Oil Engine Co. in this station. All gasifiers or free-piston engines for this station were provided by ourselves, the Free Piston Engine Co. Ltd., of Feltham, Middlesex, and manufactured by our parent group, Associated British Engineering Limited.

We are the main contractors for this 36 MW power station at Singapore which was officially opened on 2 July, 1960.

W. G. Fryer, C.B., C.B.E., M.I.E.E.,

SALES DIRECTOR,

FREE PISTON ENGINE COMPANY LTD.,

FELTHAM, MIDDLEX.

Lights on Motorways

I WAS most interested in the article which appeared on page 931 of last week's ELECTRICAL TIMES dealing with the motorways. I travel on the M.1 a good deal and, with regard to night driving, there is of course the hazard which is mentioned in wet weather, but on a dry night I think a lot of confusion is caused by shadows which are thrown on the stark white reinforced concrete bridgework, and I would strongly recommend that these structures should be spray painted with some green compound to cut out shadow troubles.

I quite agree with the remarks made regarding signal lights, and it is quite noticeable how many large lorries are not properly fitted with any clear means for showing what direction they are taking. In some cases lorry drivers give hand signals which cannot be seen in the dark and, more particularly, at high speed. I frequently have seen three lorries in line, one occupying each lane when passing. This should be forbidden.

W. G. Picton,

LONDON, E.C.1.

E.C.C. Size

I HAVE been approached by a private contracting electrician to give guidance on the following problem: In a recently completed installation the six 7/029 earth continuity conductors from six separate t.r.s. flat twin and earth 7/036 cables, were connected for convenience to an adequately rated brass block. He continued his earth circuit with a 7/052 conductor; after consulting table 4 of the current edition of the Institution for Electrical Engineers regulations for the electrical equipment of buildings.

He became concerned when a supply authority's workman completed the e.c.c. to the supply authority's earth terminal with a short length of 7/029.

Uneconomical—or unsafe?

Chartered Electrical Engineer.

ARC FURNACE PROBLEMS

IN the discussion on the IEE paper on arc furnaces (page 923, ELECTRICAL TIMES, 15 December), Mr J. R. Phillips (English Steel Corporation) stressed the problem large furnaces presented to supply engineers, because the power input to a furnace varied from cycle to cycle, causing a flicker on the voltage of the whole supply system. Mr H. J. Sheppard (YEB) said that for the largest furnaces, it was necessary to provide direct connection to the 132 or 275 kV system in order to obtain a system impedance low enough to reduce voltage fluctuation below noticeable level.

Mr P. R. Harrison (Birlec-Efco) suggested that of the methods discussed by the author, only the equivalent circuit was of any use, due to considerable variation of the reactance characteristic during the breaking down stage, when the electrode arms were not in an in-line position. Changes could amount to 20% of the reactance. Mr W. J. Kelsey (Metaelectric) thought it would be impossible to meet supply industry requirements about voltage flicker without resorting to expensive buffer reactors and synchronous condensers. Mr W. L. Harrison (GWB) said average working power factor was affected by furnace construction and type of electrode regulator.

E.R.A. SHOW LIMITING FACTOR IS MECHANICAL DAMAGE

HERMAL damage to the joints or the sheath and the possibility of bursting under electromagnetic forces are the three vital factors which limit the short-circuit currents that lead-sheathed, paper-insulated cables will carry with safety under short-circuit conditions. These important conclusions summarise results of the first stage of an extensive research programme undertaken by the IEEA, which was described to the IEE last week.* However, the conclusions will affect the practical design of cable joints, which formed the subject of a second paper.†

has long been recognised that the short-circuit recommendations put forward in 1937, which included the requirement that cable temperature should not exceed 90°C, were conservative, especially since Sweden, the UK and certain European countries permit a maximum conductor temperature of 200°C. The papers describe the first stage of a research programme which will eventually cover most types of cable, including those with aluminium and plastics components. In this first stage the cables investigated were single-core and belted multicore types, with copper conductors and lead or lead-alloy sheaths, suitable for voltages up to 11 kV.

Factors Considered

heating produced by the passage of the short-circuit current has a direct effect on the conductor, dielectric sheath. However, it also produces important mechanical effects indirectly, as a result of thermal expansion. Direct mechanical effects are also produced by electromagnetic forces, which tend to burst the cable. The behaviour of a cable will also be strongly influenced by repeated short-circuits which may result from the use of auto-reclosers. The authors do not deal directly with this aspect in the paper but consider it best dealt with separately, after a basis for short-circuit ratings has been established. Several secondary factors affect the cable behaviour but these were found to have little significance. The paper is based on short-circuit durations not exceeding 3 sec. This is the maximum time normally allowed by CEEGB for area boards to disconnect a faulty network. Although conductor maximum temperature was shown to be less of a limiting feature than other factors, relevant insulation charring the peak conductor temperature should not exceed 270°C. It could be rather more for small, rapidly cooled conductors, or rather less for large, air-cooled conductors. For drained or aged and dry cables, the assumption that all heat is retained was experimentally justified so that heat losses should be neglected in assessing peak temperature. However, for new, well-

impregnated cables, energy losses up to 20% at 300°C were found on some samples.

The maximum sheath temperature must be restricted to between 200°C and 250°C, for above this temperature range serious damage may be caused by fracture due to thermal expansion and possibly by changes in the sheath material structure. Both circumferential and longitudinal fractures of the sheath occurred on test lengths of cable, above 260°C. The circumferential fractures are attributed to longitudinal restraint imposed on the sheath by the core, while the longitudinal cracks are possibly caused by electromagnetic hoop stress between conductor and sheath.

In contrast with the conductor tests, the maximum temperature in the sheath was found to be significantly less than that calculated by neglecting heat losses. For different sizes of cable in air, the temperature reduction varied from 10% to as high as 25% and nearly doubled if the cable was embedded in compound. For wire-armoured cable, the paper recommends basing temperature rise on total energy absorption, allowing for current division between sheath and armour as deduced from their relative resistances at 20°C. On this basis, the heat losses from the cable provide a temperature safety margin of at least 10%. This recommendation is subject to two important qualifications; for the purposes of temperature rise calculation, tape armouring should be ignored, and account should be taken of reduction of cross-section due to corrosion for steel-wire armoured cables.

Mechanical Forces

Fault currents which are quickly interrupted, say in 0.2 sec, may cause insufficient heating to damage the cable thermally, yet the resulting electromagnetic forces may

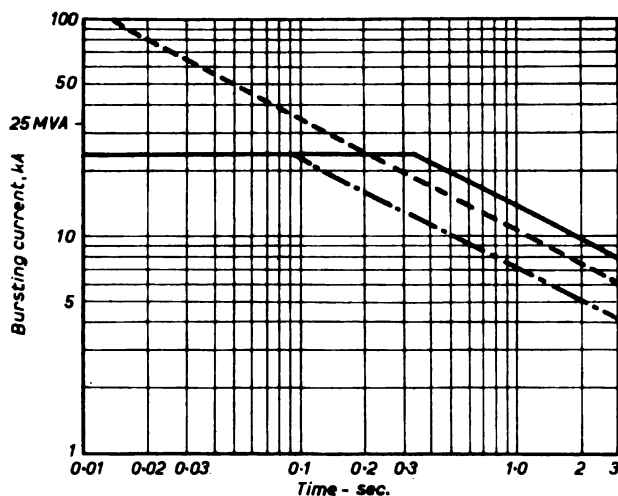


Fig. 1. 1938 and 1960 recommendations compared for the safe current carrying capacity of four-core 0.2 sq in. p.i.l.c.s.t.a., 1,100 V cable under short-circuit conditions:

1938 based on 120°C conductor temperature: _____
 1960 based on 160°C conductor temperature _____
 and bursting current limitations: _____
 1960 based on 250°C sheath temperature: _____

**paper No. 3314: "A Basis for Short-Circuit Ratings for
r-Insulated Cables up to 11 kV," by L. Gosland, B.Sc.,
E., and R. G. Parr, B.SC.(ENG.), A.M.I.E.E., both of ERA.**
**paper No. 3284: "Short-Circuit Ratings for Mains Cables,"
J. S. Buckingham, B.SC.(ENG.), M.I.E.E. Mr Buckingham
chief engineer, MEB.**

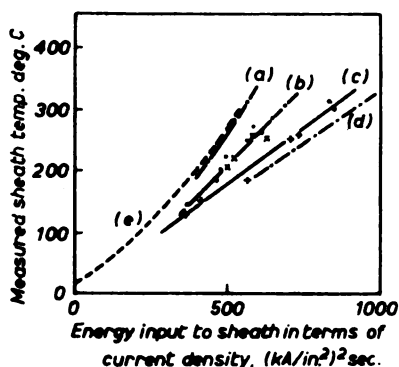


Fig. 2. Heat losses from sheaths in air. Variations in tightness of sheath on core probably accounts for differences. (a) 0.0225 sq in., 1-core; (b) 0.15 sq in., 1-core; (c) 0.15 sq in., 3-core; (d) 0.15 sq in., 1-core; (e) theoretical, no heat loss

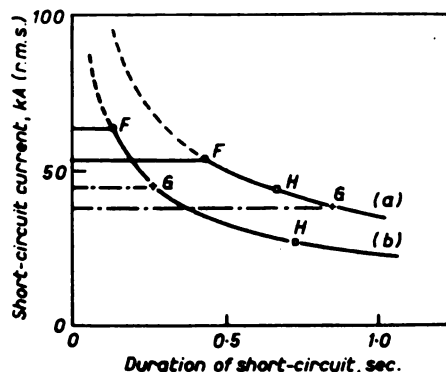


Fig. 3. Bursting limitation on short-circuit current: (a) 0.5 sq in., 1,100 V; (b) 0.3 sq in., 11 kV. F represents theoretical bursting current; G represents suggested limit to avoid bursting; H represents maximum current of standard o.c.b.

burst the sheath and belting. This condition applies only to cables with large conductor cross-section and will not apply to cables protected by h.r.c. fuses.

Cable joints in multicore cables are vulnerable to another side-effect of heating. Thermal expansion of the cable may cause the joints to yield in compression. Higher voltage joints proved more consistent than low-voltage joints in the tests conducted by ERA, probably because of the spacers incorporated in them. With porcelain spacers, 11 kV cables were found to be about 30% weaker than those with pre-impregnated paper spacers. The authors suggest minor changes in practice could ensure that joints at all voltages up to 11 kV could be constructed to have the recommended minimum strength of 8,000 lb/sq in. of total conductor cross-section.

Safety Criteria

From their experimental results, the authors conclude that sheath currents are decisive for all cables except very small unarmoured multicore cables, s.w.a. three-core 11 kV cables up to 0.3 sq in. and s.w.a. four-core 1,100 V cables up to 0.5 sq in. If the fault lasts for 0.2 sec or less, bursting currents are decisive for 0.3 sq in. and larger 11 kV cables and for 0.2 sq in. and larger 1,100 V cables. These limits can be waived with h.r.c. fuse protection.

Consideration of mechanical stress due to thermal expansion indicates that conductors of 11 kV multicore cables should not be allowed to exceed 120°C above a temperature at the mean of the normal operating range and known as the stress-free temperature. For 1,100 V cables the figure is 100°C. Recommendations for actual cables sizes are given in the first paper. Under short-circuit conditions, the sheath temperature, with heat losses neglected, should not be allowed to reach 250°C.

Provided the three-phase fault current is equal in magnitude and duration to the earth fault current, either the sheath or the conductor current limitations may be decisive, depending on the cable construction. In all cases, the limit is based on mechanical damage to sheath or joints. Insulation charring and melting of solder do not impose more severe limitations on short-circuit current ratings.

Application to H.V. Networks

Curves based on the ERA recommendations for various cable sizes are given in Mr Buckingham's paper. He points out that modern joints are better able to withstand buckling than older designs and for the older types safe currents should be reduced by 10%. In this context, end dividing boxes are regarded as joints.

A single-core construction must be used for p.i.l.c. cables linking grid transformers to 11 kV or 6.6 kV switchboards because of the heavy load currents involved.

Phase-to-phase faults are unlikely to develop on such a cable run and, if they occur in any other part of the system, provided the switchgear clears the system within 3 sec no damage would result to the cables. However, an earth fault to the sheath could damage the sheath. But provided the normal practice of earthing the system neutral through a resistor limiting the current to 2 kA is adopted, no further special precautions are necessary.

For three-core 6.6 kV or 11 kV feeder cables the wire armouring

relieves the lead sheath from the full fault return current and the conductor temperature becomes the limiting factor. The efficacy of the armouring may, however, be affected by corrosion, especially in bad soil, and it may then be better to regard the cable as lead-sheathed only. If the sheath is not in good condition, or if tape armouring is used, sheath temperature again becomes the limiting condition under double earth fault conditions and even 0.5 sq in. cable is safe for only 1.3 sec. For this reason, single-wire armoured cables are advised where the short-circuit level is high.

In connection with high-speed interruption of circuits, although cables can be disconnected in less than 0.2 sec it is considered better practice to regard this as the minimum time, to allow for back-up protection to come into operation in the event of failure of the high-speed protection.

Distribution Substation for H.V. Networks

If a 33 kV distribution system is used from the grid substation for transformation to 11 kV and it is assumed that the system reactance limits the fault level to 150 MVA, then a three-core 0.2 sq in. p.l.y.s.w.s. 11 kV feeder cable is safe for 3 sec and a similar 0.1 sq in. cable for 1 sec.

The new ERA recommendations are more onerous and indicate the need for system design to meet short-circuit conditions. Larger conductors may be necessary than have been used in the past, and single core cables may need to be more widely applied to limit phase-to-phase faults. Perhaps the use of screened cables should be encouraged.

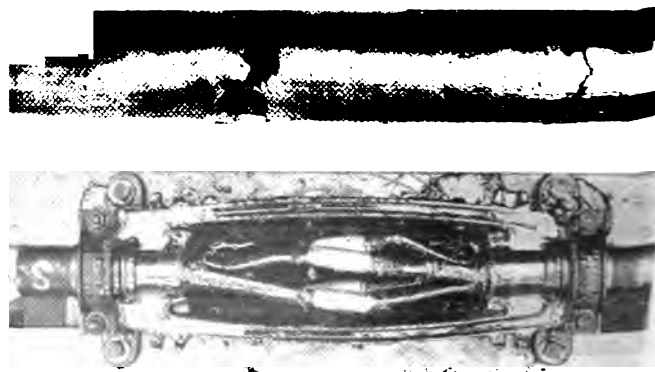


Fig. 4. The top picture shows longitudinal and circumferential fractures caused by thermal expansion. Below is illustrated joint damage due to compressive forces in an 1,100 V four-core cable box

L.V. Networks

The findings show that l.v. networks cannot be adequately protected by devices taking 3 seconds to operate, and h.r.c. fuse back-up protection is essential. Even a 100 kVA, 433 V transformer would need a single core 0.6 sq in. cable on the l.v. side to be safe for a 3 second fault duration.

On large solidly interconnected l.v. networks fed from a number of medium-size transformers, the faults would generally take the form of high resistance earth faults and temperature limits would not be exceeded. The value of such networks would in general outweigh damage which would result from the relatively infrequent occurrence of more serious faults.

Underground service cables are perhaps the greatest risk. A 600A fuse would give adequate protection to a twin

0.0225 sq in. p.l.y.s.t.s cable solidly connected to a 4 core 0.3 sq in. main with a 25 MVA short-circuit level, near a substation. But, at a distance of 500 yards, the length of the fuse blowing time would permit serious damage to any cable smaller than 0.06 sq in. Such a fuse rating must be matched with load conditions and due allowance be made for load growth. The new recommendations are unlikely to affect sizes of l.v. distribution mains.

Most of the recommendations, particularly the use of h.r.c. back-up fuses, apply to industrial installations. In power stations, it is the practice to use a minimum of 0.2 sq in. 3-core cables for connections to 3.3 kV 150 MVA switchboards. These cables would withstand the short-circuit rating for 0.3 seconds, but it is important to ensure that terminating boxes on equipment are large enough for this size of cable and the short-circuit conditions. Otherwise, breakdowns in terminal boxes may increase.

DISCUSSION

Mr L. H. WELCH (LEB) said the authors had made out a good case for the use of armoured cables and confirmed his opinion that, in certain respects, tape armouring was not much use. However, the paper indicated wire armouring was more economic than a plain lead sheath. He thought Mr Buckingham's tables and comments should be made available to every distribution engineer. The screened cable had many advantages, its only disadvantage was price. He said he would like to see more standardisation of low voltage jointing techniques and he thought they probably required more care than 11 kV joints. The three-second duty was rather onerous and probably only occurred on 11 kV systems when busbar faults were not cleared by protection gear.

Mr P. M. HOLLINGSWORTH (BICC) said that little was known about cable short-circuit behaviour before the ERA investigations. Although cables had operated satisfactorily for a half a century without this knowledge they may not continue to do so in the future. He asked how it was that the Europeans got away with 200°C rise when the paper recommended only 160°C. Could it be the result of more rapid fault clearance? The behaviour of the lead sheath under short-circuit rating was the most important limiting factor for unarmoured cables. If the lead sheath thickness were reduced to line up with Continental standards the situation would become worse. Clearly there was a need to study the economics of short-circuit ratings. The recently introduced corrugated aluminium sheath with a thickness of only 1/64 in. had ratings between 1½ and 2½ times that of a lead sheath.

Mr R. S. ORCHARD (Merz and McLellan) said the decision would now be necessary whether to apply the 160°C criterion for pressure and solid cables at higher voltages and whether it would be satisfactory practice. The effect of oil ducts and reinforcement in gas pressure cables may make this temperature restriction rather conservative. He commented on the wide time range used in the papers from 0.2 sec to 3 sec. If times could be standardised for various

applications it would be possible to use a simple table. He suggested allowing 1 sec for circuit-breaker operation by discriminating type of relays and, perhaps, 0.5 sec for power station instantaneous protection and for h.r.c. fuse protected cables, 0.2 sec. Mr Buckingham's paper was based on 3.3 kV and 400 V systems with resistance earthing. However, this was not the general practice on many systems. For these circuits, earth fault indication would be most valuable.

Mr C. C. BARNES (CEGB) said that some of the recommendations in the paper implied much larger cables sizes than are now used for certain applications. In his experience there were few concrete cases of cable short-circuits. The papers, unfortunately, only applied to a very limited range of cables and investigation was urgently required of thermoplastics and pressure-assisted cables for all voltages.

Mr D. E. BIRD (Ewbank and Partners) commented that plain lead-covered cables should be avoided where possible. If an earth fault was outside the cable run, fault current would be shared by the three cables. He asked if, on circuits with auto-reclose, the authors could give some idea of a factor to apply for different intervals of time.

Mr D. T. HOLLINGSWORTH (BICC) suggested that the cables tested were not specifically designed for the short-circuit ratings used. It would be possible, at extra cost, to increase the robustness of cables, for example, by increasing the hardness of the lead sheath and armour.

Mr A. G. THOMAS (Alcan) gave some comparative figures for aluminium sheathed cables.

Mr MIRANDA (Pirelli-General) speaking on behalf of Mr Morello, commented on temperature limitations for lead-sheath cables. He thought 160°C a better sheath temperature than the 200°C recommended by the authors, while for short-circuit forces he thought currents about half the value suggested by the authors should be used. 200°C was not safe enough but, perhaps, 160°C was rather too conservative, although it allows for mechanical deterioration caused by ageing of the dielectric.

Mr J. SOLOMAN (CEGB) spoke with reference to power station design. The paper referred to use of earthing resistance particularly for greater than 150 MVA ratings, but several installations were operating with cross sections very much less than 0.2 sq in. as recommended in the paper, possibly due to faster clearing times. Referring to h.r.c. fuse back-up protection for o.c.b. and a.c.b's, there were a few installations with medium voltage o.c.b's, the tendency now being to use metalclad air circuit-breakers. Back-up fuses should be used to limit the effect of short-circuits in motor terminal boxes.

Mr H. BARNES asked for the authors' opinion on how, after some years' operation, to ensure effectively that fault currents flowed back through the armouring. He suggested p.v.c. sheathing as a necessity to overcome the difficulty of armouring corrosion.

Mr C. T. W. SUTTON (Enfield-Standard) expressed himself as being a little worried by the complexity of the new suggestions. ERA had done good work but there seemed to be many complications in applying their findings. Other countries did not see all the complications envisaged in the paper. Would it be possible to increase the rise from 120°C to 160°C with simpler qualifications than those given in the paper?

In reply, Mr Parr confirmed that the findings were applicable to armoured cables. Although as Mr Orchard had suggested, the temperature limits of 250°C and 160°C probably applied to e.h.v. cables, they considered it wise to have experimental evidence before specifying these limits.

In reply, Mr BUCKINGHAM said no doubt it was the high quality of cables used in the past that had prevented more serious operation troubles. Aluminium developments for cables were being closely watched, but jointing techniques and anti-corrosion finishes were still not entirely satisfactory. He agreed with Mr Bird that auto-reclosing must be used with care. The MEB used it only in cases where the fault level was fairly low say 35 MVA. It could not be applied to city networks.

PROGRESS IN PATENTS

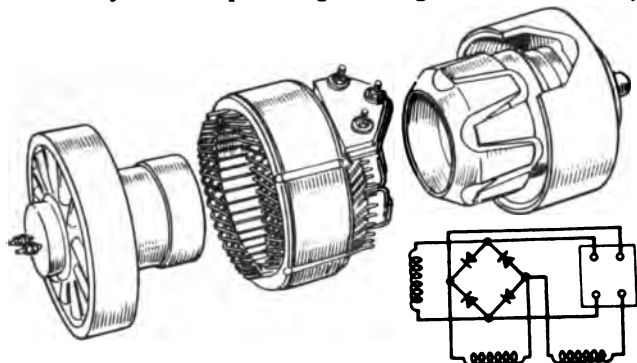
SELECTED SPECIFICATIONS

Brushless Alternator

There is currently a spate of interest in brushless alternators. True, most development is concentrated on smaller output machines for aircraft, automobiles and marine applications but some ideas could easily be applicable to larger generators. Many are based on the use of semiconductor rectifiers incorporated in the rotor with induced a.c. in a subsidiary winding. A different approach is described in Specification 855,551, attributed to General Motors Corp. of Detroit, USA, in which the rotor is a two-pole inductor revolving round a stationary field, the three-phase stator being conventionally placed around the rotor.

The exploded view, reproduced here, shows the exciter field in the form of a cylindrical core magnetised on a horizontal axis by circumscribing windings, the whole being attached to one end-plate. The inductor, a hollow cylindrical assembly of pole pieces supported on non-magnetic annular spacers which, in turn, are attached to the shaft running in bearings on the opposing end-plate, is so arranged that alternate poles are inductively magnetised, north and south, by the field of the stationary cylindrical core. The conventional three-phase stator winding is supported between the end-plates and energised by rotation of the inductor in the usual manner.

Field winding excitation is via rectified current derived from one stator winding through a voltage regulator, shown conventionally as a square in the diagram, supplemented by the compounding winding connected directly



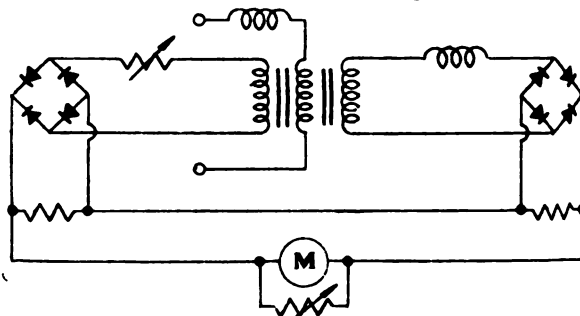
Exploded view of the GMC brushless alternator

across the rectifier. The function of the latter is to relieve the regulator from carrying all of the exciter current.

Frequency Meter

If an impedance is connected in series with an inductor across an a.c. supply, the inductor being designed to reach saturation every half-cycle, it can be shown that the voltage drop across the inductor will, in theory, be independent of supply voltage amplitude but will vary with supply frequency. Such a circuit is, for several reasons, impractical as a frequency-measuring device but, in Specification 855,566, filed by Ferranti Ltd. of Hollinwood, a development of the circuit does, it is claimed, yield accurate measurement of frequency. The inductor is a three-winding transformer, the core material of which

has a B-H loop characterised by rapid saturation at flux densities normal to primary excitation. The secondary windings are opposed across rectifier networks, one in series with a high reactance, the other with a variable resistance, the outputs of which are coupled to identical resistances in series with a d.c. moving coil voltmeter. By



Schematic circuit of the Ferranti frequency meter

adjusting the resistance at normal frequency to balance with the inductor, no current will flow in the voltmeter circuit, the null position of which is scaled to read normal frequency. At other frequencies, swings either side of the null position are suitably scaled, while the range of the meter may be adjusted by a further rheostat across the meter movement.

Golf Story

If racing be the sport of kings, golf may be called the sport of presidents. Our American cousins take their game very seriously. They may not, as yet, have applied computer techniques to the analysis of swing but, if patent 855,529, in the name of the Victor Development Co. of New Jersey is anything to go by, they are certainly on their way to doing so.

Briefly, the invention, a golf practice device, comprises a platform on which the golfer stands as he makes his swing at a captive golf ball or "ball simulation" (which, in itself, is enough to make a guttie turn in its grave) standing on a stem before his feet. The platform also incorporates a pattern of photo-electric cells while, over his head, a light is focused downwards. As he makes his stroke the shadow of the club passes over the photo-electric cells, the swing is analysed, together with the force of impact as detected by the "ball simulation," and the result is presented as a pattern of lights on an opaque glass fronted panel "on which a pictorial representation of a golf course or portions thereof may be applied." A coin-operated mechanism controls the number of shies—pardon, "strokes" he can have for a penny. All of this naturally calls for complex electrical circuits with valves, thyratrons and what-have-you which takes no less than 17 pages to describe, with 15 drawings to boot.

The French have a saying, "*chacun a son goût*." For our *goût* we'll take the rolling fairway, sandy bunker and lush velvet green, not a half-cousin to a juke-box or a one-arm bandit.

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OVERSEAS NEWS



from our correspondents abroad

CANADA

Decision Expected

ecting the long-term plans Canadian power to the ted to be taken shortly nal Energy Board. The hearing applications from for permission to export present, all power exports under temporary permits d can complete hearings cases. Applicants for ex- r must have contracts undertakings willing to wer in the US and must it is surplus.

Water Heating

time in 50 years, severe on the Winnipeg River the shut-down of three ions, at Pine Falls, Great McArthur Falls. Although ave been made to import Ontario and a further Saskatchewan, a rationing e necessary.

Supply

re in August which des- of the main buildings in section of Baie Verte also power station which was d and operated. At the e Government, the New- ht and Power Co. have : town's system and it is new generating unit will on before Christmas.

for Revelstoke

ceremony, the Cranberry lectric project, about 15 Revelstoke, was inaugu- oject now includes four a capacity of 2 MW.

AMERICA

in the Argentine

it for the construction of er station under the El lectric project has been Agua y Energia and the The cost of the project million pesos. It is also arge the Chivilcoy power stimated cost of 190 mil-

New Station for Colombia

It is reported that the Bogota Electric Co. is planning to construct a 33 MW thermal power station near Tocancipa, about 25 miles north of the capital.

Japanese to Study Brazilian Power

Power potential of the River Parana, near Sete Quedas, is to be studied by a Japanese team with a view to constructing a number of power stations utilising falls in the region. The company handling the scheme is the Companhia Hidroelectrica das Sete Quedas, who were responsible for constructing the first section of the Pedreira plant.

U.S.S.R.

Natural Steam Power Project

Following a survey of underground steam generation by volcanic activity, the USSR has decided to construct a power station in the Kamchatka district with two low-pressure turbines rated between 2.5 MW and 3 MW, in the valley of the River Pauzhetka. Boreholes drilled during the exploratory stage yielded up to 150 tons of steam/hr. It is proposed to design larger stations with capacities from 50 MW to 100 MW following the conclusion of geological surveys which will begin in 1962.

Another Volga Hydro Station

Claimed as the world's largest hydro-electric power station, the 2,500 MW hydro-electric plant at Stalingrad on the Volga came into full production recently. Stalingrad is the seventh of ten hydro stations being constructed along the Volga and its tributary, the Kama. The station will enable a unified grid system to be operated west of the Urals. Three other hydro-electric plants on these rivers are nearing completion, each with a capacity exceeding 1,500 MW.

AUSTRALIA

Consultants Recommend Merger

Savings of £50,000 rising to £170,000 by 1965 would be possible by merging the Brisbane City Council and Southern Electricity Authority undertakings, say the British consultants, Merz and McLellan. This recommendation was referred to by Mr Smith, the State Electricity Commissioner, when he presented

the annual report. Some of the consultants' recommendations have already been implemented, said Mr Smith, and others were under consideration. He said the Commission were interested in the use of natural gas for power production at Roma and were watching the aluminium development plans with a view to new power stations on the open-cast coal fields in Central Queensland. In the year under review, over £10 million was spent on electrical development and 18,000 new customers were connected.

Aluminium Plant Expansion

A rise in aluminium production at the Aluminium Corporation's Bell Bay Works to 28,500 tons/annum will increase electricity requirements to 67 MW, possibly by 1963. This was stated by the Premier, Mr Reece, in the House of Assembly recently when he gave notice of the Bill to approve the sale of the aluminium undertaking at Bell Bay. A second high voltage transmission line between Trevellyn and Bell Bay would supply the additional power, and survey work for the line is now under way. Expansion would also necessitate new power generation facilities in the future. The Bell Bay expansion forms part of a vast aluminium project in Australia and New Zealand referred to in ELECTRICAL TIMES for 24 Nov., which is being undertaken by the American Kaiser Aluminium Chemical Corporation and the British Consolidated Zinc Corporation. Expenditure in Australia may amount to £125 million in the next six years and, in addition to increasing the Bell Bay smelter capacity to 60,000 tons, plans are in hand for a 360,000 tons/annum aluminium plant and bauxite mine at Weipa in Queensland.

The possibility of aluminium developments at Weipa strengthens the view expressed in some quarters that a large new power station should be built on the Callide coal field.

Aluminium Tanked Transformers

A contract for three 240 MVA, 16.5/348 kV three-phase generator transformers has been awarded to Ferranti. The transformer contract, valued at over £400,000, has been placed by the NSW Electricity Commission for the Vales Point station, about 70 miles north of Sydney. The transformers will have high-speed on-load tap changing gear and, to reduce weight for transportation, they will be enclosed in aluminium tanks.

Personalities *in the industry*



Mr R. W. Dowsett



Mr R. Morgan



Mr A. W. Sinclair



Mr E. R. Acraman



Mr A. H. W. Dell

Deputy general manager of MK Electric Ltd. since January, 1958, **Mr R. W. Dowsett**, ASSOCIATE I.E.E., has been appointed a director of the company as from 2 Jan., 1961. Mr Dowsett joined MK over 36 years ago and has been an executive director since 1944.

Formerly sales manager, **Mr R. Morgan** has joined the board of Morphy-Richards (Cray) Ltd. as home market sales director, and **Mr A. W. Sinclair** has been made a member of the board of Morphy-Richards (Astral) Ltd. with the position of sales director. Mr Morgan started with Morphy-Richards 21 years ago and represented the company in Lancashire, Yorkshire and then London and the Home Counties before being appointed sales manager five years ago. Mr Sinclair joined the Astral Co. in 1950 as sales manager but left them in August, 1959, to take up a similar post for the Electrical Division of Parkinson Cowan Appliances Ltd. He relinquished that position about the middle of this year and was with Merseyside Engineering (Refrigeration) Ltd. for a short period until rejoining Morphy-Richards (Astral) recently.

Members of the Electricity Board for Northern Ireland have been reappointed to continue in office for a further two years. They are: **Mr J. Walker** (chairman), and Messrs **A. G. Algeo**, **G. Matthews**, **J. R. W. Murland**, **A. Shiells** and **W. D. Smyth**.

Mr R. Cox, works manager of Low Moor Fine Steels Ltd., and **Mr B. P. Yates**, F.C.I.S., director of Low Moor Alloy Steelworks Ltd. and Brayshaw Furnaces Ltd., have been appointed additional directors of Low Moor Fine Steels Ltd.

Two special directors of the Yorkshire Switchgear and Engineering Co. Ltd. have been appointed. They are: **Mr G. E. Lowe**, who has been chief engineer since 1950, prior to which he was chief draughtsman and chief designer successively, having joined the company in 1939; and **Mr A. R. Rumfitt**,

A.M.I.E.E., who has been technical sales manager since 1956. Mr Rumfitt joined the company in 1941 as chief test engineer following which he served with the Yorkshire Division of the Central Electricity Authority and returned to the company in 1950 as technical manager.

Mr E. R. Acraman has been appointed a director of Pope's Electric Lamp Co. Ltd. He has been sales manager of the company for the past four years and will continue to be primarily concerned with sales promotion activities.

Chief engineer of A. Reyrolle and Co. Ltd., **Mr W. Gray**, M.I.E.E., A.M.I.MECH.E., has been co-opted to the board of the company. Mr Gray was educated at Sunderland Technical College, and after serving an apprenticeship in marine engineering, was employed by a Manchester firm manufacturing steam and diesel engines. He joined Reyrolle and Co. in 1929, and after service in various sections of the Engineering Department he was eventually appointed engineer-in-charge of the protection and control unit. In 1954 he became assistant chief engineer and four years later was promoted to his present position.

Mr R. C. Ray has been appointed sales manager of Wild-Barfield Electric Furnaces Ltd., his operations also covering the subsidiary, the Applied Heat Co. Ltd. Mr Ray joined the design and drawing office of Wild-Barfield in July, 1937, and continued studies at the Northampton Polytechnic. After service in the RAF, during which he was awarded the D.F.M. and subsequently commissioned, he rejoined the company in 1946 and moved to the sales office, of which he was appointed manager in 1957. Mr Ray's new appointment is part of an internal reorganisation, most of which was carried out earlier this year. Under this **Mr W. R. Brew** became executive manager (engineering), **Mr F. L. Gladwin** was made executive manager (commercial) and **Mr O. V. Metcalfe**, executive manager (production).

Sales manager of Chloride Batteries Ltd., **Mr A. C. Stewart** is approaching retirement age and will not be moving to the firm's Clifton Junction Wks to where the Technical Production and Sales Departments are transferring on 2 Jan. He will be succeeded by **Mr M. A. Griffith-Jones** on completion of the move, but Mr Stewart's services are being retained in a consultant capacity until he retires. Mr Stewart, who has been sales manager since June, 1956, after a year as assistant sales manager, joined the company in 1921 and was for 24 years manager of Drydex dry battery sales.

The Eastern Electricity Board have appointed **Mr A. H. W. Dell**, A.I.M.T.A., as accountant of their Norfolk sub-area in succession to **Mr L. W. Jordan**, A.I.M.T.A., A.S.A.A., A.C.I.S., who has taken up a similar position at the Board's Northmet sub-area (*ESH, page 109). Mr Dell started his career in the Norwich Borough Treasurer's Department, later moving to the West Ham Corporation as personal assistant to the borough treasurer. He joined the Eastern Board and the Norfolk sub-area in June, 1948, in the sub-area accountant's department, being promoted to principal assistant (final accounts) and first assistant to the sub-area accountant in 1952. He recently attended a joint management course at Horsley Towers.

Cable and Wireless Ltd. announce that **Mr A. S. Pudner**, M.B.E., A.M.I.E.E., A.M.B.I.R.E., formerly area engineer, West Indies, is to be an additional assistant engineer-in-chief. In addition, **Mr R. A. Rice**, A.A.C.C.A., assistant accountant, is to be deputy chief accountant in succession to **Mr A. J. Silwood**, who retires on 31 Dec., 1960. **Mr W. I. Mercer**, A.A.C.C.A., will be assistant accountant in place of Mr Rice, and **Mr P. A. McCann**, head of Traffic Circulation Section, is to be an assistant traffic

* Denotes revision to the "Electricity Supply Handbook, 1960."

ager in succession to Mr V. A. Wil-
s, who also retires on 31 Dec. Mr
er joined Cable and Wireless Ltd.
January, 1934. His first overseas post-
was to Bermuda as assistant engineer
938 and, after a short spell as assis-
electrician on a cable ship, he
ed in Athens and Haifa. He went
Korea in 1950 to be assistant engineer
harge of the company's field wire-
unit. In 1952 he was awarded the
E. for carrying out duties in Korea
beyond the call of duty. Later he
ed in Hong Kong and, in August,
he was appointed branch and area
ner in Barbados, visiting many of
company's stations in the West
Is. He returned to England on
Dec. to the Engineer-in-Chief's Dept.

the Crown Agents for Oversea
ernments and Administrations have
ointed Sir James Farquharson,
ral manager, East African Railways
Harbours, as engineer-in-chief in
office to succeed Sir Reginald
lor, who retires on 30 April next.

the Minister of Power has re-
ointed Mr D. Bellamy, C.B.E., D.L.,
M.A., COMP.I.E.E., F.R.ECON.S., F.S.S.,
hairman of the Yorkshire Electricity
rd for a further period of one year.

P. Buchanan, J.P., is retiring from
time membership of the Board at
end of December on completion of
term of office (*ESH, page 141). Mr
amy has been chairman of the YEB
early in 1952, having previously
manager of the Board's No. 6 sub-

deputy overseas manager to British
lated Callender's Cables Ltd. since
, Mr T. E. H. Birley, O.B.E., has
ed after 40 years' service with the
pany. Born in Manchester in 1898
educated at Marlborough and Pem-
te College, Cambridge, where he won
Classical Scholarship in 1916, Mr
ey served as a pilot in the Royal
ng Corps and joined Macintosh
le Co. Ltd. in 1920. He transferred
British Insulated Cables Ltd. in 1936
n Macintosh became absorbed by
BI Co. and served that concern on
y trade association committees until
outbreak of war. From 1942 to 1945
up-Captain Birley, as he then was,
assistant secretary on the War
inet Secretariat in Washington and
his services there he received, in 1947,

the American Legion of Merit—Degree
of Officer. The importance of his work
in America was also recognised in the
1946 New Year's Honours list by the
award of the O.B.E. After the war he
returned to BICC as special representa-
tive on overseas sales and in 1950 be-
came regional manager for Central and
South America.

Well known in the electrical acces-
sories field, Mr P. E. Wheatland has
retired from the General Electric Co.
Ltd. after 47 years' service. He started
with the company in 1913 and, rejoining
them after war service, worked in the
various sales departments. To gain ex-
perience he then spent some time with
his family contracting business and with
Servial Refrigerating Co. He became
assistant manager of the Electrical Ac-
cessories Department of the GEC in
1946 and, subsequently, was appointed
manager in 1949. In 1958 he was made
deputy manager of Installation Equip-
ment Division. Mr Wheatland was a
member of the BEAMA Accessories
Section Standing Committee and was
chairman for one year. He also served
on the AMEWA, the SSFG Section
Standing Committee, the NICEIC and
was a member of the BSI for ELE/4.
He was also the company's representa-
tive on the Fair Trading Council. Mr
Wheatland's chief hobby is his garden
and, on his retirement, his many friends
in the company subscribed towards a
fully equipped greenhouse for his new
home at Ringwood, Hampshire.

Three staff promotions at the Electrical
Research Association are announced. Mr
L. Gosland, B.SC.(ENG.), M.I.E.E., becomes
deputy director, in addition to his posi-
tion of research manager which he will
continue to hold; and Mr C. G. Garton,
M.I.E.E., and Mr E. W. Golding, O.B.E.,
M.SC.(TECH.), M.I.E.E., M.A.M.I.E.E., are
appointed assistant directors. Mr Garton
will continue as head of the Materials
Department of the ERA and Mr Golding
will continue as head of Rural Electrifi-
cation and Wind Power Department and
also as overseas liaison officer. Mr Gos-
land was educated at Tain Royal
Academy, Ross-shire, and Glasgow
University. He did his electrical training
with Barr and Stroud, Glasgow, and
joined ERA in 1925. He is chairman of
the Commission Mixte Internationale
pour la Protection des Lignes de Tele-

communications et des Canalisations
Souterraines (CMI). He is also chair-
man of the CIGRE sub-committee on
radio and telephone interference and has
been a member of the committee of the
supply section of the IEE. Mr Garton,
who is currently chairman of the
Measurement and Control Section of
the IEE, was educated at the Rugby
College of Technology and received his
industrial training with British Thomson-
Houston. He was with the All Union
Electro-Technical Institute in Moscow
from 1933 to 1937 when he joined the
ERA and has been head of their
Materials Department since 1946. Mr
Golding was educated at the Manchester
College of Technology and received his
early training with Metropolitan-Vickers.
He has been with ERA since 1945. Prior
to this he was a lecturer in electrical
engineering at Nottingham University.
Mr Golding is a member of the Arid
Zones committee of UNESCO and
numerous other associations. He has
written several standard text-books and
has travelled extensively, being particu-
larly well known for his activities in
connection with rural electrification and
wind power.

Mr W. T. James has resigned from
the board of the British Electric Traction
Co. in view of his impending re-
tirement. Mr Paul Adorian has been
appointed to the board to fill the vacancy.

Mr Philip V. Summer has announced
his intention of retiring as chairman of
Dictograph Telephones in June, 1961.
It is his intention to remain an ordinary
director of the company.

Johnson and Phillips Limited announce
that following the retirement of Mr
W. J. Richards, chairman and chief
executive of Johnson and Phillips (Aus-
tralia) Pty. Ltd., and Mr F. N. Skinner,
managing director, changes have occurred
in the administration of their Australian
subsidiary, and that Mr A. E. Woollas-
ton, formerly general manager, overseas,
has been appointed managing director.
Mr Richards and Mr Skinner are both
very widely known in Australia in elec-
trical circles and retire after long and
distinguished service with the company.
Mr Richards joined the J. and P. Aus-
tralian organisation in 1928 and, after
some years as general manager, was
appointed chairman and chief executive
of all the company's interests in Aus-



Mr T. E. H. Birley



Mr P. E. Wheatland



Mr L. Gosland



Mr C. G. Garton



Mr E. W. Golding

tralia, in November, 1949. It was largely due to Mr Richards' instigation that the switchgear factory at Liverpool, near Sydney, was established. Mr Skinner is retiring for health reasons. He has been with the J. and P. Sydney branch for 29 years and, after many years as manager of the branch, he was appointed managing director of J. and P. (Australia) Pty. Ltd. at the beginning of 1959. Mr Woollaston, who joined J. and P. in 1945 as managing director, now becomes responsible for all J. and P's affairs in Australia. After service with Bombay branch, Mr Woollaston set up the J. and P. manufacturing branch in Karachi and, in 1956, returned to London to take up the post of general manager, overseas, which he held until his recent appointment.

Due to ill-health Mr William Hill has resigned from the position of sales director of Burco Ltd., and the company's sales and all sales personnel is now controlled by Mr Kenneth B. Holman, general sales manager.

Mr P. Winter has been elected executive director of Easiclene Porcelain Enamel (1938) Ltd.

Mr J. P. V. Woollam has been appointed deputy chairman of Simon-Carves Ltd. He joined the company in 1916 and was appointed a director in 1945 and a joint managing director in 1953. He is also a director of the holding company, Simon Engineering, and of several subsidiary and associated companies.

Technical engineer with Hackbridge and Hewitt Electric Co. Ltd., Mr H. E. Forrest, A.M.I.E.E., left last week-end for a five-week visit to India, calling at Bombay, Madras and Delhi before returning to England via Colombo.

Engineer of No. 2 sub-area of the Yorkshire Electricity Board for the past four years, Mr J. S. Yates, M.I.E.E., A.M.B.I.M., has been promoted to deputy chief engineer to the Board in succession to Mr P. C. Phillips, B.Sc., M.I.E.E., who is now the Board's chief engineer, as we earlier reported (*ESH, page 141 and 143). Prior to going to the Huddersfield sub-area, Mr Yates was section head, planning and development, at the No. 2 (Bolton) sub-area of the North Western Electricity Board.

After 40 years' service with Superlamp Ltd., Mr L. G. Lyon, a director and general manager of the company, retires at the end of this month. His colleagues presented him with a tape recorder at a farewell party.

General Manager of the General Electric Co.'s Magnet Works, Mr A. R. Green, F.C.I.S., is retiring on 31 Dec. after 40 years' service with the company. He started initially in the Accounts Department at Witton and in 1924 became assistant accountant, Engineering Works, Witton. By 1929 he was chief accountant of the Magnet Works and was appointed manager of the works. Mr Green started the Swinton Works

in 1945 and acted as joint general manager of the Magnet and Swinton Works. In 1957 he became general manager of both works, but he recently relinquished his post as manager of the Swinton Works. In 1957 he was elected a director of the Parkhall Pottery Co. Ltd.—a GEC subsidiary and from 1957-59 he was a director of the Irish AET Works.

Sales manager with B. and F. Carter and Co. Ltd., Mr V. L. Pinnock, M.S.M.A., has been appointed to the board of directors of the company.

OBITUARY

Mr W. W. Cook, M.I.E.E., M.I.C.E., formerly a consulting engineer, died on 16 Dec., aged 93.

NEW LITERATURE

Garcke's Manual of Electricity Supply 1959-60

THE long line of Garcke's Manuals comes to an end with this fifty-seventh edition, but that does not detract from the value of this volume which fully maintains the tradition of its predecessors. The presentation follows that of earlier editions, with a general survey of electricity supply progress in Britain, followed by operational statistics of generating stations, and the area boards down to district level. A section with similar details of undertakings in Scotland and Ireland is followed by financial and other particulars of many manufacturers, a list of associations and a directory of personnel, all compiled with a great deal of care. Originally compiled under the direction of the late Emil Garcke, the Manual has come to be regarded as an institution in many reference libraries and there will be genuine regret at its cessation. Its first edition, published in 1896, a copy of which we still hold in our files, refers to the industry then having upwards of £50 million of capital invested in it, but that included telephone, telegraph and traction companies. How times have changed! And now Garcke's stops. Published by Electrical Press Ltd., 756 pages, 8½ in. by 5½ in. Price £4 4s.

Uses of Electricity in the Oil Industry

edited by E. A. W. Reeves,
D.F.H., A.M.I.E.E.

ONE of the fascinations of electrical engineering is that it embraces every industry without exception. The engineer of experience may, when changing jobs, find himself in an entirely new field which, electrically, differs little from the last or in one which has its own special electrical problems, hazards, etc., with its established techniques of dealing with them. Such an industry is oil, from drilling, pumping and transporting to processing in the refinery.

Should an engineer be contemplating joining an oil company, this book will be invaluable to him. It is not just a textbook written by an individual; it is a series of contributions by 22 specialists from oil companies, research organisations and manufacturers of electrical

equipment for hazardous environments, neatly brought together and prefaced by the editor. There is also much which could equally apply to mining and certain chemical industries. Published by Ernest Benn, 286 pages, 9 in. by 6 in. Price 50s.

Transformers and Generators for Power Systems

by R. Langlois-Berthelot

THIS translation from the original French context by Lt-Col H. M. Clarke, of King's College, is actually two books in a single volume. The first, of 227 pages with 53 pages of references, deals with transformer theory and design; the second, of 161 pages with another 53 pages of references, covers similar aspects of the synchronous machine, both as a single generator or operating in parallel with others. The translation shows little evidence as such; it could easily have been mistaken for the original. The style is concise and the mathematics clear. Though aimed at the student—as a companion to a previous work, *Electro-magnetic Machines*, by the same author—it is also useful to the practising engineer concerned either with design or operation.

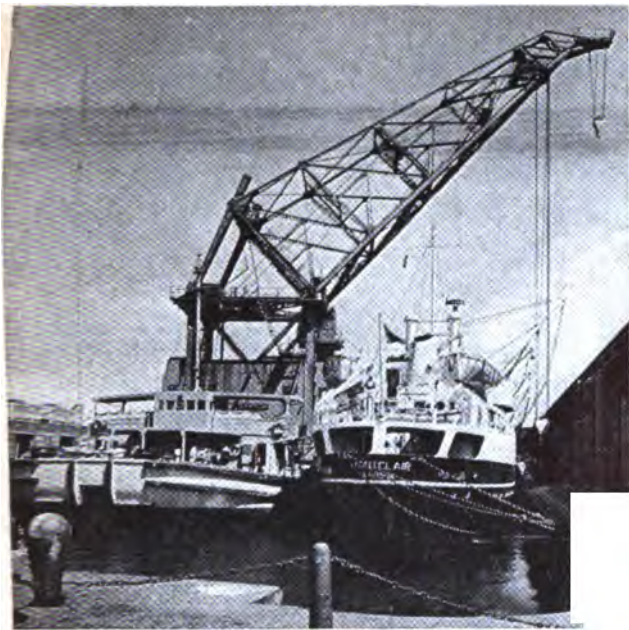
The extensive references are, perhaps, of questionable value to the student who may not have access to them; nor is there much point in leaving some untranslated. One of the clearer textbooks on the subject. Published by MacDonald and Co., 533 pages, 8½ in. by 5½ in. Price 65s.

BOOKS RECEIVED

The 15 Wonders of the World, by R. Poirier. Account of 15 major engineering feats in history, ranging from the Tower of Babel and the Pyramids to the Volga and Tennessee hydro schemes and the Oak Ridge atomic power project. Published by Victor Gollanz Ltd., 400 pages, 8½ in. by 5½ in. Price 25s.

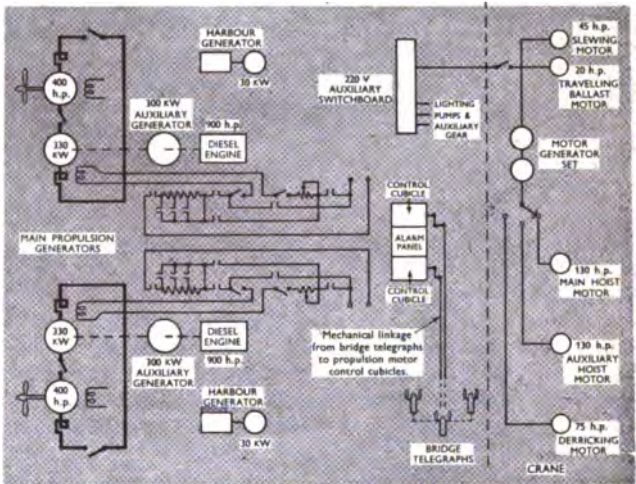
An Introduction to Electrotechnology, by S. J. Kowalski. Text-book for Part I Applied Electricity paper for London B.Sc.(Eng.) degree. Published by Chapman and Hall Ltd., 301 pages, 8½ in. by 5½ in. Price 35s.

Basic Ultrasonics, by C. Glickstein. American book giving elementary introduction to subject, covering equipment and applications. Published by Chapman and Hall, 137 pages, 9½ in. by 6 in. Price 32s.



60-ton floating crane

ELECTRICAL EQUIPMENT OF THE "SAMSON"



Circuit diagram of crane and propulsion equipment on the "Samson"

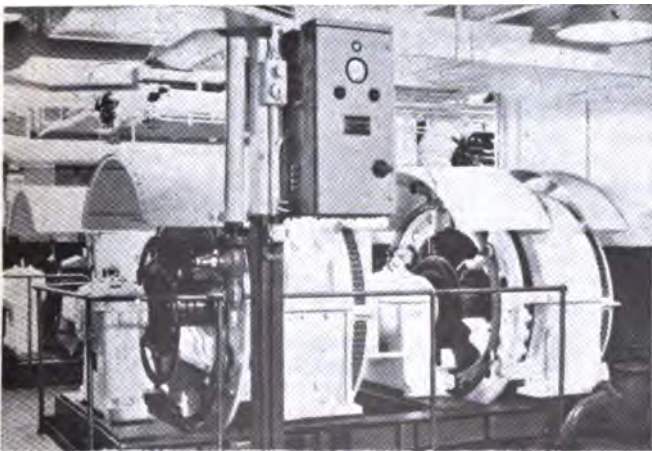
THE new 60-ton twin-screw floating crane "Samson," commissioned earlier this year by the Mersey Docks and Harbour Board for Liverpool Docks, is diesel-electric powered with electrical equipment supplied by the GEC. The hull has an overall length of 183 ft, a breadth of 56 ft, and the crane has a capacity of 60 ton up to a radius of 78 ft 8 in. with an auxiliary hoist of 25 ton up to a maximum radius of 93 ft 8 in. A power-driven counterbalance and derrick hoist is also incorporated.

Propulsion is by two 400 h.p. motors with Ward-Leonard control supplemented by a 200 h.p. bow-steering pump capable of exerting a two-ton thrust in either direction. Control of propulsion is from engine-room telegraphs on the bridge mechanically linked to the panels in the engine-room, with facilities for local control.

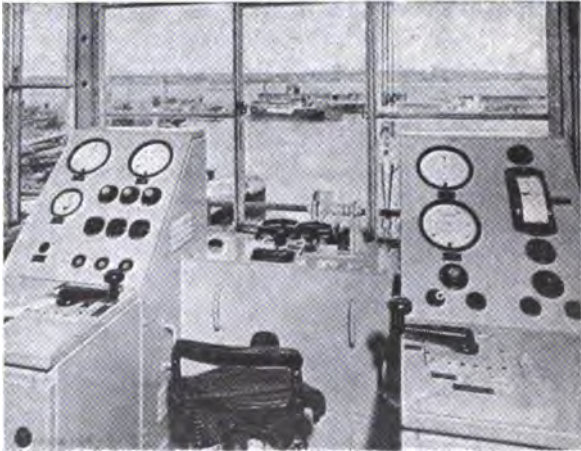
Power for the 130 h.p. crane hoists and the 75 h.p. derrick motor is obtained from a 107 kW Ward-Leonard set. Slewing and ballast motors, the former of 45 h.p. and the latter of 20 h.p., are series wound and are supplied from the 220 V auxiliary generators. At the crane control desk a central three-position switch enables either of the crane hoists or the derrick motor to be selected for control from the lever type, nine-notch controller which operates on the separately- and self-excited fields of the Ward-Leonard set. On the console to the right is the control

for the ballast motor with, above, the instruments and ballast position indicator; on the left is the slewing motor control with, above, hoist selector indicator lights, Ward-Leonard controls and limit switch override buttons.

The two main generators are rated at 330 kW, 440 V d.c. and these supply the propulsion motors. They are driven by 900 h.p., 600 r.p.m. Paxman YLXZ diesel engines, to which they are coupled by Twiflex articulated flexible couplings. Also on the same shaft are the 300 kW, 220 V auxiliary generators which supply the crane hoist sets and other motors. The rating of the latter is such that a single generator is capable of supplying the entire crane and service load. Two 30 kW, 220 V diesel sets provide power for essential services when the main units are shut down. All electrical equipment is fully provided with protective devices.



Port main propulsion and auxiliary generators



View from the crane operator's control desk

Conductor stringing calculations

DETERMINATION OF TEMPERATURE DIVIDING LINE

by E. M. Clackson

SINCE the advent of suspension-type construction in the form of wood pole transmission lines, there has been a tendency to deviate from the generally accepted equivalent span method of conductor stringing. This tendency may primarily have its origin in the rather lengthy calculations required to produce an equivalent span sag and tension chart which, in turn, demands a considerable amount of careful interpretation on the part of the field engineer. Secondly, there is always the possibility that theoretically rigid shackle poles will require the added expense of stays to deal with unbalanced loading due to unequal equivalent span sections.

The alternative method which appears to have received considerable attention in the industry is to tension the conductors throughout the whole length of the line to the equivalent tension of the complete line (equivalent line) or to the same tension that would be obtained in the maximum single span. This method, while more economical in some respects, will result in the maximum working tension being exceeded under certain conditions and the minimum factor of safety required by the Electricity Commissioners not being attained.

This statement can be substantiated by a glance at almost any sag chart of the equivalent span type, from which it is evident that at some temperatures the tension will be greater in the smaller spans while at others, where the temperature curves slope in the opposite direction, the tension will be greater in the larger spans. There is, in fact, a definite dividing line somewhere in the temperature curves where tension is constant, irrespective of the equivalent span. If this dividing line is above the highest practical erection temperature, the alternative stringing method could be used with safety. Where the dividing line is somewhere within, or even below, the normal range of erection temperatures, it would be dangerous to do so.

Some will maintain that the alternative equivalent line method is more desirable in view of its simplicity but it must be borne in mind that each section of line between shackle positions will, after erection, react in a fashion similar to the equivalent span of the section and not to the equivalent tension of the complete line. This will again cause out-of-balance loading at shackle positions and considerable deflection of the insulator strings, particularly when subjected to adverse weather conditions.

If the alternative method is considered, before preparing sag charts and templates, etc., for a proposed line, it is expedient to determine the exact temperature at which the tension will remain constant irrespective of span length, i.e., the dividing line. This can be found by referring to the basic formula used to determine tension variations due to altered loading:

$$(C_1 W_2 L / T_2)^2 - T_2 = (C_1 W_1 L / T_1)^2 - T_1 + C_2 l$$

where $C_1 = \sqrt{EA/24}$ (A is the conductor area in sq in., E is the elastic modulus of the conductor); $C_2 = \alpha EA$ (α is the coefficient of expansion); W_1 = weight per foot run of conductor when fully loaded at T_1 , the maximum working tension; W_2 = weight per foot run of conductor and T_2 = the

conductor tension when the temperature has risen or fallen by t° ; L = the length of the span.

Any variation in weight per foot run through thermal expansion or contraction and/or icing will produce a corresponding variation in tension and it can be shown from the sag formula, $S = WL^2/8T$ that, for a given conductor, W/T is a constant when in an isolated span. But at the dividing line temperature, the sag is equal to that obtained at the initial condition and W/T is a constant irrespective of span length. As a result, the two quantities in brackets in the above formula are mathematically identical in this particular application, therefore it can be reduced to:

$$T_2 = T_1 - C_2 l$$

That is

$$l = (T_1 - T_2) / C_2$$

and, of course,

$$T_2 = (T_1 W_2) / W_1$$

Let us consider a practical example. Assuming an 0.175 sq in. s.c.a. conductor (37/110) with $\frac{1}{8}$ in. ice and 8 lb wind at 22°F and a maximum working load of 4,000 lb. Then $W_1 = 1.2175$ lb/ft, $W_2 = 0.57$ lb/ft and $C_2 = 47.97$. On this basis

$$\begin{aligned} T_2 &= (T_1 W_2) / W_1 \\ &= (4,000 \times .57) / 1.2175 \\ &= 1,872 \text{ lb} \\ l &= (T_1 - T_2) / C_2 \\ &= (4,000 - 1,872) / 47.97 \\ &= 44.35^\circ\text{F} \end{aligned}$$

Therefore, the dividing line will be 44.35°F above the initial temperature; that is, 66.35°F .

Let us now prove the example by finding the tension at 66.35°F in spans of 200 ft and 500 ft using the formulae. For a 200 ft equivalent span,

$$\begin{aligned} C_1 &= 441.5 \\ C_1 W_2 L &= 50,330 \\ (C_1 W_1 L / T_1)^2 - T_1 &= -1,873, (C_1 W_2 L / T_2)^2 - T_2 = -1,151 \\ \text{For } (50,330 / T_2)^2 - T_2 &= -1,151, T_2 = 1,872 \text{ lb.} \end{aligned}$$

In this last equation the tension T_2 is normally found by trial and error on a slide rule: from the example we know the tension should be 1,872 lb.

For a 500 ft equivalent span,

$$\begin{aligned} C_1 W_2 L &= 125,800 \\ (C_1 W_1 L / T_1)^2 - T_1 &= -1,873, (C_1 W_2 L / T_2)^2 - T_2 = 2,642 \\ \text{For } (125,800 / T_2)^2 - T_2 &= 2,642, T_2 = 1,872 \text{ lb.} \end{aligned}$$

The dividing line of temperature is, therefore, 66.35°F .

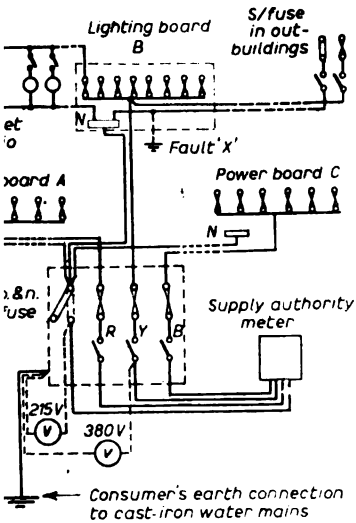
This particular example shows that it would be unsafe to use the alternative stringing method, as erection temperatures well in excess of 66.35°F are prevalent in this country. There are, however, many conductors where the physical properties and loading conditions are such that the dividing line will be well above the range of erection temperatures, which does suggest some measure of justification for the tendency to deviate from the equivalent span method of conductor stringing.

PROBLEMS AND PRACTICE

ing Circuit Hazard

LED to rectify a fault on a lighting installation in a country house, as alarmed as the owner when he ne that, on the previous evening, switching on the hall light, it had l excessively brilliantly and then l out. When this happened on circuits he wisely pulled off the switch and sent for me. Moreover, aid reported that, on the previous ion, she had switched on a radio- and smoke came from the back instrument. Wisely, she switched d drew out the plug, thinking that x had broken down. The lighting x had previously been supplied a private generating set but had hanged over to the public supply as now fed from a pole-mounted rmer, three-phase four-wire, which d an adjacent farm.

thdrew all fuses and checked the uth. The meter indicated no volts n the red phase and earth, 215 V n neutral and earth and 380 V n yellow and earth. I immediately d the supply company who sent an er post haste to the scene. I after- was told that the star point earth tion on the transformer had been faulty while, at the farm, there n earth fault on the red phase here in the consumer's installation. : diagram shows, this can lead to ous voltages on a consumer's es where there is no fault.—E.L.O.



A fault in the neutral line from a unvented transformer plus an earth fault on other consumer's premises creates unusual voltages on a domestic installation

Low Voltage Lampholders

THE extending practice of using low voltage lighting on machine tools, etc., wholly to be commended, has, however, its own problems. Chief of these are the softening of solder on the lamp contacts, failure of plunger springs and the use of unventilated metal shades.

The temperature reached in low voltage lampholders is, to the uninitiated, rather surprising. In one case a 6 V 18 W s.b.c. auto bulb mounted in a small unventilated metal shade carried on an adjustable arm reached a temperature far in excess of that which could be touched with safety and was certainly in excess of the melting point on the soft solder on the lamp contacts. Admittedly the ambient temperature was high by reason of the motors, pumps and heaters which were part of the related machine tool installation.

The first step taken was to replace the soft solder on the lamp contacts by h.m.p. solder. This was done at our request by the lamp makers and initially reduced the number of failures. Ultimately, however, the plunger springs failed presumably under the combined heating effects of the 3 A current and excessive lamp cap temperatures. The final cure was to fit small edison screw holder, using s.e.s. lamps with the same lampshades. It is essential to realise that the conditions are vastly different from those in motor car headlamps for which the bulbs and holders were originally designed.—F.S.

Earth-free System Faults

A "FAULT in the Dark" (page 813 24 Nov.) could have been brought to light much sooner, a busy service engineer employed on more important work and the voltage regulator left undisturbed by the installation of a simple and effective earth leakage indicator.

Used extensively on unearthed d.c. systems, it consists of two lamps of equal voltage in series across the bus-bars with the centre connection earthed. Any number of these indicators may be installed. For example, one should be sited at the generator room with others at vantage points throughout the building. Fault indication is shown as follows: An earth-free condition would be indicated by both lamps being of equal brightness. An earth fault brought about by an earth on one busbar would be indicated by unequal brightness, the resistance of the earth fault determining the amount of difference in lamp brightness. A high resistance fault would show

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

as minimum difference and a low resistance fault as a practical extinction of one lamp and full brightness on the other. A broken filament in one indicator would show as a fault condition on others but this is rare because the lamps normally operate at half system voltage.—Centri.

Ion Replies—

Had such a form of indicator been installed in the laboratories, it would not have disclosed the fault earlier for the simple reason that its location lay at a mid-point between the two busbars—i.e., between the 50 V lamp and 60 V dropper resistance and so corresponds to the earth connection of another two-lamp indicator in parallel. By the same reasoning, an earth fault on the mid-point of a motor shunt field winding would not be disclosed until a second fault arose. With all such devices, there is no positive indication of faults occurring at or near the mid-potential point on a system. The only safe indicator is an earth leakage indicator inserted in one earthed bus-connection and, in fact, this was what was eventually installed. Incidentally, it is important to realise that two apparently identically voltage-rated lamps in series across a higher voltage system do not necessarily glow with equal brightness. They have to be selected on their current rating as anyone who has had experience of series lamp circuits on traction voltages will know. All such lamps are rated for current, not voltage alone.—Ion.

That Man Again!

LAST year I gave you my tip on the use of test-lamps. Here is another useful pointer. As a maintenance engineer I am mystified by some of the antics recommended in these columns to dry out electric motors which have become immersed. My method is to switch it on and keep it running. Sometimes the motor dries itself out but, usually, of course, goes up in flames. Then I send it to be rewound and it is as good as new.

Another useful tip in locating faults. If a fault on, say a lighting circuit, will persist in blowing fuses, instead of trying to locate the fault, put bigger and bigger fuses in until something happens. Sometimes the current will blow the fault clear; on others a shower of sparks will give away the fault position.

That reminds me. Does anyone want a maintenance engineer? My firm has just been gutted by fire.—M. E. N. Ace.

equipment for industry

Resin-bonded glass-fibre tubes

TUBULAR components manufactured from resin-bonded, helically wound glass-fibre rovings are being developed by Permal Ltd. for electrical applications. Technique used enables production of tubes from 1 in. to 4 ft 6 in. dia in lengths up to 20 ft. Among advantages claimed is that maximum strength of the material can be developed in any particular direction to suit the mechanical design of the component to be manufactured. Typical applications are transformer tanks and turbulator pots for high voltage circuit-breakers. *Permal Ltd., Gloucester.*

General purpose gas turbine

NOW being distributed in this country is the US built "Saturn" gas turbine, a general purpose main or auxiliary power unit. It has a continuous rating of 1,250 h.p. at 20,000 r.p.m. with a fuel consumption of 0.6 to 0.63 lb/h.p. hr. The machine is claimed to operate efficiently on a number of fuels including petrol, paraffin, diesel and natural gas and to give quick and reliable starting under a wide range of climatic conditions. Suitably geared-down, the unit should find useful application as a prime-mover for standby electric generating sets. The "Saturn" weighs only 950 lb and has overall dimensions 69 in. long by 45 in. wide by 44 in. high. *Perkins Gas Turbines Ltd., Peterborough.*

Digital volt/ohm meter

TRANSISTOR circuitry techniques are made use of in a recently introduced instrument which can measure voltages from 1 mV up to 1.1 kV and resistance to 1.1 megohm. Readings are

displayed in digital form on a lamp-projection type indicator on the front of the instrument. Alternatively, there is provision for coupling to a line printer or reperforator unit, made by the same company, which will permanently record readings. The instrument thus lends itself to incorporation in data logging systems. Price is £385. *Venner Electronics Ltd., Kingston By-pass, New Malden, Surrey.*

High-speed batch counter

AN electronic batch counter with a dekatron presentation and capable of counting at a maximum rate of 500/sec using photo-electric viewing heads, is a recent addition to the Elcontrol range of industrial electronic instruments. The total count is displayed up to a maximum of 9,999 and automatic reset features are incorporated. The counter is 9 in. deep by 16 in. wide by 13 in. high. A smaller counter, the BC2, with cyclometer presentation has a rate of up to ten counts/sec. *Electronic Control Engineers, Wilbury Way, Hitchin, Herts.*

Miniature wander-plug and socket

DESIGNED specifically for use with printed circuits, the new "Clix" miniature wander-plug and socket has dimensions conforming with the standard 0.1 in. module. Thus, the socket body has a diameter of 0.19 in., making it suitable for mounting on 0.2 in. centres, while the socket mounting pin is 0.05 in. dia and 7/64 in. long. The plug body is 1/4 in. long by 0.19 in. dia and has a 0.04 in. dia 1/4 in. long contact pin. Bodies are in moulded red or black nylon and contact surfaces are silver plated. *AEI Radio and Electronic Components Division, 155 Charing Cross Rd, W.C.2.*

The Digilog

THE Digilog is a metering device for collating analogue signals from a number of sources, converting them to digital form and presenting the results in schematic form on a chart. In addition, any readings which depart from a predetermined safe level are printed in red or, alternatively, it could be so arranged to print only when such levels were exceeded. The chart recorder has been specially developed to withstand continuous 24-hr operation and the system can be applied to such tasks as monitoring the temperature distribution pattern in nuclear reactors. *Bailey Meters and Controls, Purley Way, Croydon.*

Drum heater

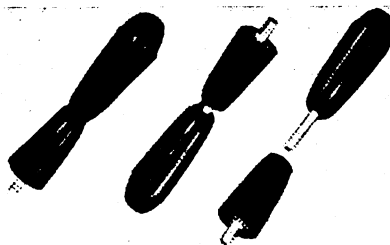
A ROBUST accessory for applying heat to drums containing materials which are viscous or solid at normal ambient temperatures, thereby facilitating emptying, the "Electrothermal" drum heater is in the form of a 5 1/2 in. wide band of stainless steel held closed by a stout coil spring. It will encircle drums ranging in diameter from 22 1/2 in. to 23 1/2 in. An enclosed electric heating element rated at 2 kW, 200 V to 250 V, provides the heating and it has been designed specifically for 40 gall to 50 gall capacity drums. The weight of the unit is 9 lb and the price, £21. For controlling one or three heaters, energy regulators are also available. The single-element regulator is priced at 65s; the three-element unit at £9 2s 6d. *Electrothermal Engineering, 270 Neville Rd, London E.1.*

Cam-operated switch

A RECENTLY introduced switch has two leaf-spring contacts operated by a shaft-mounted cam. Rating of the contacts is 1 A at 110 V, or 2.5 A at 24 V, non-inductive and the shaft, supported by sealed bearings, can be driven at high speeds. The unit was primarily designed for use in conjunction with an electro-magnetic counter, but with an alternative cam form it is claimed to be particularly suitable for limit switching of rotary valve actuators. The unit is housed in a splash-proof light alloy casing suitable for either foot or flange mounting. *Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs.*



Venner digital volt/ohm meter can measure voltages from 1 mV to 1.1 kV and resistance up to 1.1 megohm



▲ AEI miniature wander-plug and socket is dimensioned to suit 0.1 in. module printed circuits

High speed cam-operated switch by Lancashire Dynamo has a splash-proof light-alloy housing



for the electrical trade

of lighting diffuser panels

RANGE of 2 ft square diffuser panels is announced consisting of signs in handy boxes of six each. Panels are of translucent plastics are suitable for displays, stores, and eventually, the makers hope, home. The designs comprise one model and five patterned. Prices new panels, identified from Type A pe F, are £8 18s 3d, £9 12s 6d, £9 9d, £10 6s 3d (two models) and 9s 3d per pack. *Courtney, Pope rical) Ltd., Amhurst Park Wks, ham, N.15.*

for local extraction

extractor fan designed to provide entilation for comparatively small has just been introduced. It is le for installation in kitchens, y over or as near as possible to rs, to remove odours and fumes t at their source. The whole bly is contained in a metal box square overall, with internal and al louvres to be fixed flush with ill after installation.

fan on/off cord switch is linked he internal adjustable louvres and the fan operates automatically the louvres are opened. This switch half-position for partly opening uvres when ventilation without ex-n is required. Outer aluminium is fully weathered and supplied ed if required. The impeller fan is three-bladed and formed from s. A speed regulator, M.75, is mended as an optional extra. This tor has a housing of stove enamel-uminium and should be wall- ted adjacent to the cooker which tractor serves. Gross weight of the nit is 18 lb 7 oz. "Mechavent 75" III. Price £12 17s 6d. *Greenwood's irvac Ventilating Co., Beacon Hse, way, W.C.2.*



Electroluminescence

WHAT was probably the first domes- tic application of the electrolumin- escent light source was described on this page in 17 Nov. issue when we described a new device for locating switches and sockets in the dark. We are now able to illustrate the locator and, below, are pictures of its interior and of an actual installation. In normal light it is a square white panel, but in dark- ness, when connected, the transparent outer frame glows bright green—high- lighting the fixture screwed to its face. The panel will accommodate any acces- sory having 2½ in. fixing centres.

It may be remembered that the new light source came into the news some months ago when an American manufac-

turer introduced a small circular night light utilising the phenomenon. Even more recently the same maker produced an even larger, square version. Current consumption of these panels is infinitesimal.

The new locator, which is 3½ in. square, is modestly priced at 5s 8d. *M.K. Electric Ltd., Shrubbery Rd, N.9.*

Fan heater with 360° outlet

A FAN heater, introduced recently, expels heated air through 360°. This is a 2 kW heater of the type employing a horizontally mounted fan impeller. Warm air is expelled from the upright cylindrical casing through louvres which extend all round the unit. The heater is controlled by a four-position switch, giving 1 kW, 2 kW, "fan only," and "off." It includes the usual safety cut-out which operates in the event of fan failure or on obstruction of the air supply, and has an internal lamp to indicate when the element is on. The steel casing is stove enamelled in four combinations, light and dark grey, grey and yellow, blue and grey and black and off-white. It stands 15½ in. high and is 14½ in. in dia. Price of the new heater, known as "Sunset," is £11 5s, tax paid. *Best Products, Ranelagh Hse, Felixstowe, Suffolk.*

TRADE PUBLICATIONS

STATOMAT.—Descriptive folder on a machine for the automatic lacing of stator windings. Southern Tools, 22 Upper Mulgrave Rd, Cheam, Surrey.

MORGANS.—Booklet KJ 83 illustrating products of The Morgan Crucible Co., Battersea Church Rd, S.W.11.

COPEs.—Four-page leaflet No. P1007, describing systems of desuperheating and pressure reducing. Copes Regulators, 9 Southampton Pl, W.C.1.

BULGIN.—Leaflet describing new range of moulded, single-pole rocker-contact switches with central "Off" position. A. F. Bulgin, Barking, Essex.

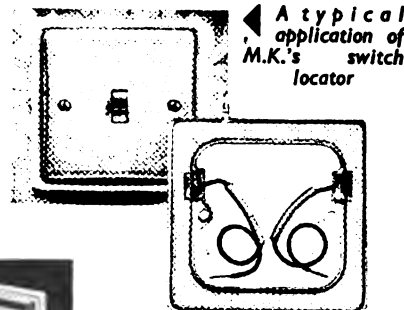
E.M.I.—Short form illustrated catalogue

of products from the instrument division. Oscilloscopes, stroboscopes, closed circuit television, electronic photographic equipment, nuclear health instruments, analogue computers and instrumentation tape decks. E.M.I. Electronics Ltd., Instrument Division, Hayes, Middx.

THERMOFLASH.—Eleven-page illustrated brochure describing water distillation plant, land based and marine units. Bennis Thermo-flash Ltd., Little Hulton, Walkden, Manchester.

HYFLO.—Illustrated technical folder describing control switches for liquids; open cup type and glass-tube type. A. Kingsley Williams, Victory Wks, 4-10 Newbold Rd, Chesterfield.

KABI.—Leaflet describing Duralumin containers, tailor made to customer's specification. Also leaflet on industrial tapes, including electrical insulating tapes, double-sided self-sticking. Kabi (Electrical and Plastics) Ltd., Kabi Wks, Cranborne Rd, Potters Bar, Middx.

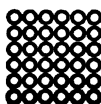


The electroluminescent light source applied to a domestic switch locator. Interior view shows two leads and resistors which are connected across line and neutral terminals. Consumption is negligible

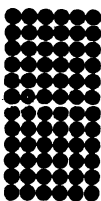
An exploded view of the "Mechavent-75" Mark III extractor fan. Complete assembly sells at £12 17s 6d



"Sunset," a fan heater with 360° air flow. £11 5s



Transformers in court



SUPPLY ENGINEERS GIVE EVIDENCE OF MORE ORDERS FOR
INDEPENDENT MANUFACTURERS. PRICE LEADERSHIP POSSIBLE?

SUPPLY industry engineers have been prominent in the list of witnesses during recent hearings before the Restrictive Practices Court of the Transformer Manufacturers' Association case. When counsel for the Registrar of Restrictive Practices had concluded his opening address to the Court, the first witness was Mr J. Eggington (chief transmission engineer, CEGB). Asked if he agreed that quality of British transformers could not be surpassed by manufacturers in other countries, he said he had no knowledge of the quality reached by manufacturers abroad. However, he agreed that research and development work carried out by TMA members was of a high standard. Moreover, he had visited, during the last three years, the works of nearly all the members of the TMA and, generally speaking, had found the standard of efficiency to be high.

He agreed that there had been a price war in the transformer industry during the years 1928 to 1930 and that there was a risk of something like that happening if the TMA agreement were brought to an end. In any future price war, money made available for research and development would be reduced, but he doubted if it would be withdrawn altogether.

Mr Eggington was succeeded as a witness by Mr L. Miller (chief purchasing and contracts officer, CEGB). He agreed that if there were a free market and the CEGB were dissatisfied with the level of prices, then they had the power to go to a manufacturer and, against a guarantee of orders, get him to reduce his price. However, it was unlikely that such a set of circumstances could arise in conditions of free competition.

Mr Miller said he would expect the CEGB to watch price levels from two points of view. First, if prices were so low as to cause concern about quality of transformers; and secondly, from the aspect of reduced prices endangering production capacity in the country. If the price-fixing agreement of the TMA were abandoned, the CEGB would put manufacture of all its transformers out to tender.

Mr E. Long (board member, CEGB) thought there was no real likelihood that the capacity of the industry in

England would be insufficient for the requirements of the Board. If it were thought that price levels were unreasonable, the Board would hold discussions with manufacturers and would always take such action as would help secure and maintain a healthy manufacturing industry. He did not think that conditions existing between 1927 and 1930, which caused a 40% price drop, bore any resemblance to conditions today.

Mr G. Nicholson (chief engineer, Yorkshire EB) said that if manufacturers were in competition and prices were "too low" his first concern would be about quality. The YEB considered it very important to have a first-class article and they would be much concerned at the possibility of deterioration in quality. Mr R. Sully (purchasing officer, Southern EB) said that in each of the four years 1956-57 to 1959-60 his Board had bought more category A transformers from independent manufacturers than from Association members. It was possible, he said, that although during this period TMA members had reduced their prices, other manufacturers had dropped theirs still further to retain a major part of the business. Mr A. Proctor (assistant chief engineer, SWEB) told Mr Justice Russell that he found considerable variation in prices quoted by independent members for category A transformers.

Mr L. Turner (purchasing officer, Midlands EB) said that independent manufacturers had substantially increased their share of business from his Board, but most of the business still went to TMA members.

Non-member Manufacturers

Mr F. Lydall (managing director, Yorkshire Electric Transformer Co.) said stability in the industry could be achieved by price leadership, in which leading manufacturers would draw up a schedule of prices considered to be economic and make this schedule available to other manufacturers as a guide.

Mr. S. Brewer, (director, Bryce Electric Construction Co.) said that in his view, there was at present a price war in the transformer business. In earlier submitted evidence, he had said that he did not think the price war would result in any deliberate sacrifice of standards, but that there had already been a reduction of "margins". He explained this by saying that particularly in the case of smaller transformers, but also in other cases, designs had been pressed to minimise prices.

On the question of the fall in export sales, he said that to compensate for the fall, he had been compelled to concentrate on the home market, without relaxing efforts to obtain export orders. Asked about discovering why any particular order had been lost, he said the electrical industry was a friendly one, and he would expect to hear from a customer if he had erred in any way.

Prof. F. Paish, an economist, agreed that the export market fluctuated, and could be very unprofitable; but it could expand.

The case so far . . .

The ten-member Transformer Manufacturers' Association is defending before the Restrictive Practices Court its agreement providing minimum prices for transformers sold for use in the UK. Witnesses for the Association have drawn attention to under-employment of the capacity of the industry at present and have underlined its difficulties in selling overseas. They have also described tentative negotiations by individual members with non-member firms in an attempt to extend Association membership. Accountants and economists have described the working of the TMA price-fixing agreement, and have said that without it home prices would fall. The case began on Monday, 21 November, and is now entering its final stages.

News of the Week

Io.W. Nuclear Station yet

West Sussex site technically unsuitable

THOUGH detailed technical investigations have shown that Hamstead, is "excellent" for the site of a nuclear power station, the CEBG have ded to defer any decision about seeking consent for such a station. In a ment issued last week the Board say that the site at Earnley, West Sussex, h was considered a possible alternative to Hamstead, has proved technically itable for development.

was in February, 1959, that the IB announced their intention of ring out detailed investigations of two locations, because of the urgent to explore ways of expanding rating capacity in the central hernal area of England. The proposal ediatly raised objections, particu- with reference to the Hamstead site the Solent a few miles from Yarth, IoW. Recently, land near the osed site passed into the owner- of the National Trust.

their statement the Board point out demand for electricity in the hernal counties is growing at a rate 0%/year, almost half as much again e average for the whole of England Wales. This demand can be met by ding stations in the Midlands, with : transmission to the south coast. the Board are reluctant to adopt second alternative too widely, both use of their policy of minimising age of transmission line and also use "the construction of power ons in the Midlands is not univer- welcomed."

or the types of nuclear power station resent being built, only two poten- promising sites between Dungeness Weymouth have been found, that at iley and that at Hamstead. Earnley asuitable for present types of reactors is "unlikely to be attractive" for e types of reactor. However, Ham- d is suitable in all respect on tech- l grounds and the Board believe they could build a station there with : real damage to amenity. They are rring any decision about seeking

consent for the site, rather than abandoning all possibility of its use.

It would be possible to meet immediate power demands in the southern counties, while minimising transmission, by building a conventional power station at Southampton Water. However, this would have the disadvantage of increasing materially the cost of power in the area of the Southern Electricity Board as compared with alternative schemes. The CEBG say they need more time for the consideration and investigation of conventional alternatives.

ANOTHER SUFFOLK STATION SITE?

SEEKING a site for a possible future power station, the CEBG wants to take over Landguard Point, on the Suffolk coast, near Felixstowe. The property is held by the War Office and negotiations are now proceeding through a Parliamentary Committee. No decision has yet been made of the type or size of power station which would be erected if the site is acquired. For several hundred years there has been a fort on the site, standing guard over Harwich harbour, and the present buildings were erected in 1875. Of course, there is said to be a ghost, which alarms sentries at night!

The garrison was withdrawn from the fort in June, 1957, and since then has been used only for the summer training of Territorial Army units.

DELAY ON COLOUR TV

GOVERNMENT approval for a BBC scheme to start an experimental public colour TV service next November will not be forthcoming, said the PMG in the House of Commons last week. He said it would be a "profound mistake" for the Government to make a decision on colour TV before the future lines standard (whether to change from 405 lines) had been decided. The director-general of the BBC, Mr H. Carleton Greene, has commented that it believed that technical problems of technically satisfactory colour TV receivers might well be solved some years in advance of substantial use of a new system at a higher lineage. Sets to the 405 line standard for colour would have had at least six to ten years' life.

TAKEOVER BIDS

The clothes dryer firm, A. J. Flatley Ltd., are involved in discussions on a takeover bid. Mr A. J. Flatley, chairman and managing director, confirmed that talks were taking place, but he could not reveal the name of the party involved as nothing was finalised, he told the ELECTRICAL TIMES on Monday.

From his offer of 6s 6d per share last June, Mr Colin Will now holds approximately 74% of the capital of E. Shipton and Co. (Holdings) Ltd., telephone and signalling engineers. The board has been reorganised and now comprises Sir Leslie Nicholls (chairman), Mr E. Shipton (vice-chairman), Mr C. Will (managing director) and Mr V. Younger.

Range Boilers Ltd. have purchased the whole of the share capital of A. C. Scott and Co. Ltd., electrical resistance wire and tape manufacturers, of Wythenshawe, Manchester. Chairman and managing director of Range Boilers, Mr E. Dickinson, has been appointed chairman of Scott's but the latter's existing directors and management continue.

2,500 damages against Eastern Board

REED damages of £2,500 for the h of her husband, a linesman's mate loyed by the Eastern Electricity rd, were awarded in the High Court week to Mrs W. P. Harris, of les. It was stated that Mr Harris from an overhead line pole after iving an electric shock, and died. ring judgment with costs by consent nt the Board, Mr Justice McNair red that £600 of that sum should o two daughters.

GLASGOW ELECTRIC TRAINS WITHDRAWN

FOLLOWING an outbreak of fire last Saturday on a train on Glasgow's recently electrified suburban railway, British Railways announced that all electric stock was to be withdrawn for investigation by the makers, in this instance, AEI. The fire emanated from two electric motors on the train, and the incident resulted in a second major breakdown on the service in one week. On the previous Tuesday, a transformer blew up on a Glasgow-bound train as it was passing Renton Station. A meeting has been held between BTC officials and representatives of firms supplying 25 kV a.c. stock equipment to all Regions of

British Railways. The meeting was primarily to ascertain whether the trouble experienced with AEI stock on Scottish Region was likely to be met with on other sections of 25 kV a.c. line in the country. An assurance was given to the effect that the fault was confined solely to equipment in use in Scotland.

A public inquiry is to open in Glasgow on 22 Dec. The Glasgow electrified services began on 7 Nov. last. There are 52 miles of track. At present 67 sets of coaches have been delivered, and when the service was withdrawn 17 of these were out of service because of mishap in some way.

Ferranti plans Scottish Expansion

FERRANTI LTD. plans to set up a new factory at Dalkeith, near Edinburgh. Negotiations are proceeding for the Midlothian County Council to build a factory on a 50,000 sq ft site at a cost of about £150,000 and let it to Ferranti. The factory would employ 300 men and 200 women. Ferranti's Scottish factories were "bursting at the seams," a company representative told the ELECTRICAL TIMES recently. The pressure on space is such that Ferranti is at present concluding a bargain under which they would occupy the Corn Exchange in Dalkeith until the new factory was ready.

The group's manufacturing in Scotland is in two main groups—computers and

control equipment for machine tools, and "Airpass" (Airborne interception radar and pilot's attack), which is being produced for English Electric's PIB Lightning. The machine tool control equipment is understood to be selling well, and exports to the US are at a high level.

GLASS TUBING EXPANSION

THE expansion of the Chesterfield glass works, to which we briefly referred last week, is part of a £1 million scheme to be completed in three years, when the tubing plant will have trebled its present capacity. The decision to expand follows last week's announcement of the new link of AEI and GEC in a jointly owned company to make and sell glass, by taking over the AEI Chesterfield glass works and those of GEC at Lemington-on-Tyne and Wembley.

By creating this larger and more economic unit it is hoped to withstand competition and overcome tariff barriers. Glass production at Chesterfield is continuous round-the-clock and consists of components for the electrical industry, including lamp making, and domestic glassware in about even quantities. Annual output is now 10,000,000 lb of high-grade glass tubing, ranging from 0.1 in. to 2½ in. dia, and 50,000,000 drinking glasses, in a variety of styles.

The expansion of tubing output is expected to require a further 100,000 sq ft of floor area.

Safety system given to Coal Board

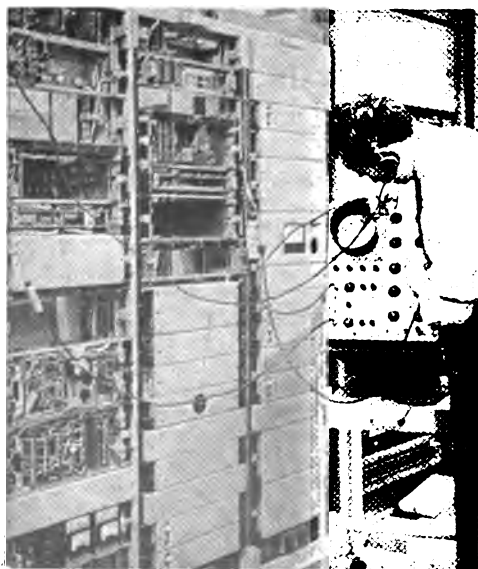
BALDWIN and Francis Ltd., Sheffield manufacturers of electrical equipment for the mining industry, have given the National Coal Board a licence to use their patents on earth leakage protection, free of charge. This gesture was made in the interests of safety, even though the NCB uses the system extensively to reduce the danger of gas exploding in the event of an earth fault, and was willing to go on paying for the privilege. The agreement will save the NCB anything up to £80,000 a year.

400 kV LINE

IN our recent report of the CEBG decision to introduce a 400 kV system, it was stated that the first line at this voltage was expected to come into commercial operation in 1962. This is incorrect; 1965 is the expected date. This line is likely to be a two-conductor bundle line. The first four-conductor bundle 400 kV line will be brought into use at a later date.

New Telephone System Trials in Madrid

A NEW telephone transmission system, using pulse-code-modulation techniques, is now undergoing extensive field trials on a working cable link in Madrid, Spain. The system has been developed by engineers of Standard Telecommunication Laboratories Ltd. in conjunction with Standard Telephones and Cables Ltd. and Le Materiel Telephonique, of Paris. It offers a tenfold increase in the number of telephone circuits possible over junction cables in towns and cities. The system was invented over 20 years ago, but is not in widespread use, being generally considered only for specialised services.



For the purpose of the tests, two Madrid telephone exchanges, Norte and Delicias, are linked by PCM equipment over an existing 6 km length of cable. The cable contains 900 pairs of wires, of which a small number are given over to PCM transmission.

CONTRACTOR OBJECTS TO APPRENTICESHIP COMPULSION

ALTHOUGH an electrical contractor may employ an apprentice electrician and observe all the terms and conditions of employment laid down in the National Agreements and Working Rules, he is not bound to register the apprentice under the present interim system. That is the basis of an award by the Industrial Court last week. The electrical contractor, T. Cowie, of Salisbury, is not a member of the National Federated Electrical Association. It was claimed by the Electrical Trades Union that he was not observing the appropriate terms agreed by the NJIC by refusing to register the apprentice. The non-registration of the employee was the only complaint the ETU had against the employer.

The apprentice was, in fact, being paid above the agreed rate of pay and enjoying a better standard of conditions than that laid down in the Agreement, the employers submitted. The Court found for the employer.

Mr T. Cowie told the ELECTRICAL TIMES last Friday that it was compulsion to which he objected. Now that he had won the dispute and was free to decide, he would register the apprentice.

OFFICIAL PUBLICATIONS

BS 3228. Procedures for Obtaining Properties of Steel at Elevated Temperatures. Part 3. Creep Strength. 3s.

Memorandum on the Post Office Bill. HMSO. 9d.

Research and Development Requirements of the Shipbuilding and Marine Engineering Industries. DSIR Report. HMSO. 1s 6d (see page 974).

Home Safety Bill. HMSO. 3d (see page 975).

C.E.R.N. Reorganised

REORGANISATION of the European Organisation for Nuclear Research (CERN) into 12 divisions, instead of the six previously existing, was announced recently by the Organisation's council. This decision recognises the fact that CERN has passed from the stage of construction to that of actual fundamental research, officials have stated. Equipment at the Geneva headquarters includes the 28,000 MeV proton-synchrotron and a 600 MeV synchro-cyclotron. In 1961, the organisation is budgeting to spend 67.7 million Swiss francs (£5.6 million). An important item in expenditure is the large amount of electric energy necessary to operate the high voltage accelerators.

Research at Imperial College

ESS with research in the electrical engineering department, Imperial University of London, is given in the recently published annual report -60. Much attention is being given to electrical machines in terms electro-magnetic properties.

been shown that forces which act on iron parts of a complex shape magnetic field can be calculated more easily than had previously been done, and the fields set up by ends of a machine are also amenable to calculation.

Natural techniques are being used in investigating improvement in the stability of power systems possible by modern types of auto-lag regulator, and experiments on other control problems is carried out with the aid of the new model power system (see p. 8).

Work in the department includes the study of control problems involving interacting variables which are met in any industrial process, oil refining. The problem is to find automatic setting of all variables to maximise some performance. Work has been revolved on gas and plasma in view of possibilities in the electricity field. Attention is being given to study of plasma phenomena. Some are built up from ions with high energy. The method is said to promise of being less subject to difficulties than methods in which plasma is first formed and then

Report also notes much activity in the field of telecommunications and concerning electrical materials.

"TRYDAN"

Given its somewhat belated appearance as the first magazine of the South Electricity Board, just published, it is produced under the name of the Welsh word for electricity. In addition to covering a wide range of activities of the Board and its employees, this first issue includes a special report on the floods in South Wales to which we referred last week. It is well worth the magazines of the boards.

Electric allegations

ALLEGATIONS that operations on the exchange involving hundreds of thousands of electric shares, played an important part in contributing to the company's trouble, were made by Mr. Cooper, MP for Ilford South, in a speech in the House of Commons last week. He called for the President of the Board of Electricity to institute a public inquiry into dealings "with particular respect to options and short selling." For the Lord of Trade it was indicated that the company being in the hands of the Receiver, made action difficult, and he asked for further information.

COALFIELD DRILLING IN EIRE

DRILLING is now being carried out in the Arigna coalfield, Eire, with a view to ascertaining the size and workability of deposits of "crow" or low-grade coal there. Mr. E. Childers, Minister for Transport and Power, told members of the Irish Mining and Quarrying Society recently. It was hoped that, as a result of the investigations, economically workable deposits of coal of sufficient quality and quantity to supply a second generating station would be located. Cost of the drilling is being met by the US Grant Counterpart Fund.

MORE FILMS FROM E.D.A.

THE latest documentary films produced for EDA deal with domestic cooking and refrigeration. Intended for showing in schools and domestic science colleges, they represent the two sides of EDA's policy of separating the "educational" from the "promotional."

In the former category are "The Modern Refrigerator" and "The Modern Electric Cooker." The first of these, lasting about 25 min, is in two parts and explains the chemistry of decay and the steps which can be taken to prevent it through refrigeration. This film deals with the compressor type refrigerator in detail, reducing the technicalities to simple images which can be readily understood. The cooker film, running for some 16 min, also makes good use of animated diagrams to show the workings and advantages of electric cooking.

The "promotional" type of film, on domestic electricity, is directed at breaking down the prejudices of older and more experienced housewives. "Time to Come," a 25 min colour film, shows

Chloride Ltd. shifts sales headquarters

CHLORIDE Batteries Ltd. are shifting their sales headquarters from London to their head office at Exide Wks, Manchester. The new arrangement, which will take effect from 2 Jan., is being made to achieve closer co-ordination with technical and production departments. London sales office will continue to handle, in particular, Government business, automotive equipment and dry batteries and, at the end of January, will move from Grosvenor Gdns Hse to 137 Victoria St, S.W.1.

Transformer Developments

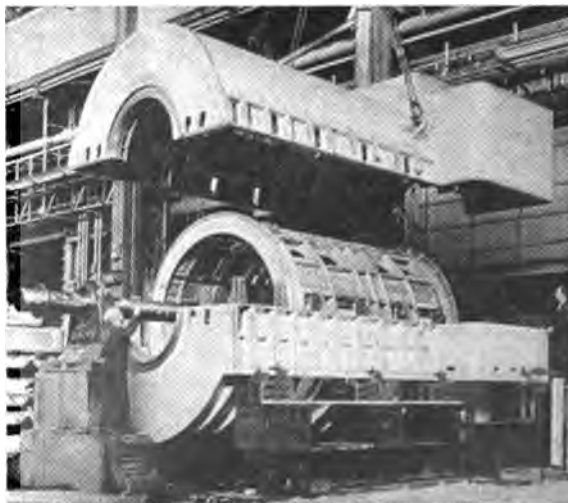
THE article, "Transformer Developments," published in ELECTRICAL TIMES, 8 Dec., 1960, referred to noise attenuation up to 35 dB by steel enclosures. We have been asked by Ferranti to point out that this should be 25 dB.

how a grandmother living alone is reluctantly converted to electric cooking, and subtly suggests that she has been given back something of the social prestige which had otherwise gone from her. This film has originality in direction and script, and is convincingly performed by well-known actresses. All the films are excellent documentaries by any standard and achieve their ends without arousing the irritation so often associated with "promotional" techniques.

Export thrust at Latin America

SCOPE of the Dollar Exports Council has been widened to cover the Caribbean and South America, and the organisation has been renamed the Western Hemisphere Export Council. Announcing this in London last week, Lord Rootes, said dollar markets were as vital as ever, but the need was for more exports overall.

Lifting the top half of a 200 MW alternator stator shell after machining the bore of the inner stator casing at GEC's Witton Works. Two of these turbo-generators are being supplied for the Kincardine "B" power station of the South of Scotland EB. In order to reduce to a minimum the transmission of vibrations from the inner stator casing to the foundations upon which the machine will be mounted, this casing is fixed to the outer shell by means of four axially-placed leaf-type springs



Electrical Firms Important in Shipbuilding

PUBLICATION last week of the much-leaked report of DSIR investigations into research and development requirements in the British shipbuilding and marine engineering industries emphasises the importance of some large electrical firms to those industries in terms of propulsion equipment. The report is generally critical of the research and development effort of the industry.

The report comments that R and D work in regard to marine propulsion installations is handicapped by the organisational structure of the industries producing propulsion units and auxiliaries.

Today, ship propulsion is either by steam turbine or diesel. So far as diesel engines are concerned, there is only one independent British designer for the large units (over 5,000 h.p.) although others manufacture under licence. The report says that continental designers have led the way in this field, where they are large-scale producers supporting relatively large research and development teams in contrast to relatively small British firms.

Marine turbines for merchant ships are made in the UK by 17 firms plus AEI. All except AEI are members of the Parsons and Marine Engineering Turbine Research and Development Association (of which, in fact, C. A. Parsons ceased to be members in 1951). The report notes that large electrical industry turbine manufacturing groups are not members of the Association. When EE Co. applied for membership in 1947 their application was rejected. In 1957, the Association suggested to EE Co., AEI, C. A. Parsons and GEC,

together with General Electric and Westinghouse of America, an arrangement for interchange of information and test facilities, but these offers were declined.

The DSIR committee found conflicting evidence as to whether British marine turbine designs were as good as foreign turbines or not. Some critics considered that firms like AEI and EE Co. should be encouraged to enter the marine field so that the benefits of their "very considerable research and development" could be available to counter foreign competition.

L.D. nuclear order

AN order for nearly 400 permanent-magnet motors, for operating the reactor control rods of the Trawsfynydd nuclear power station, has been placed with Lancashire Dynamo and Crypto Ltd.

Class "H" insulated to operate in an ambient temperature of approximately 100°C, the motors will be operated from a variable frequency supply so as to have a final speed of between 0.2 r.p.m. and 0.7 r.p.m.

E.A.W. Conference

The annual conference of the Electrical Association for Women is to be held in London on 1 and 2 May, 1961. There will be an evening reception at Goldsmith's Hall on 1 May, and the a.g.m. at Kingsway Hall on 2 May will be followed by luncheon at the Connaught Rooms.

TWO NEW SERVICE CENTRES

NEW premises were opened by two area boards during the past week. S Wales EB's plans for new headquarters for Carmarthenshire district were fulfilled and MEB opened a new showroom at Shard End Crescent in the south east district of Birmingham.

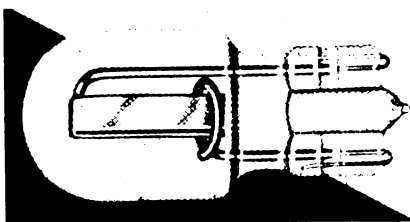
Building of SWEB's new district h.q. began on a corner site in Carmarthen's main shopping centre a year ago. After being divided in two of the oldest buildings in the town, district headquarters

and showroom are now housed in a contemporary two-storey building. Passers-by can see the whole of the showroom through the open glass front and glass swing doors, as the 900 sq ft area is lit with 6.6 kW, made up of a composite tungsten and fluorescent centre panel supplemented by wall brackets. Adjacent to the showroom are a demonstration area, with modern kitchen layout, and a room for interviewing customers. The whole building is heated by 80 kW of off-peak floor-warming. An infrared heating system will be installed in the cantilever canopy above the pavement early next year. The front of the building is trimmed with Westmorland slate and the side is Tyrolean rendered.

The showroom at Carmarthen is shown in the bottom picture. The top picture shows Northfield centre, which opened in the south west district of Birmingham recently.

Miniature all-glass starter switch

WHAT is believed to be the first miniature all-glass capless starter switch in the world has been developed at the Leicester headquarters of the AEI Lamp and Lighting Co. Ltd. Its use is expected to be principally in association with tubular fluorescent lamps and fittings. Similar in appearance to the new Mazda all-glass capless lamps, the new switch has the same robust pre-formed glass base. Its glass bulb is only $\frac{1}{8}$ in. in diameter yet it is designed to operate all wattages of fluorescent lamps up to and including 80 W, to the performance standards required by BS 2818, Pt. 3. Patents have already been applied for this switch, which lends itself to wide use with simple and compact forms of socket.



The switch, twice actual size



Top: A feature of the showroom at Northfield, Birmingham, is a luminous ceiling, supplied by Courtney, Pope (Electrical) Ltd. Made up of specially designed 3 ft sq translucent panels, this section is lit by 8 ft 125 W lamps.

Right: The contemporary style of Carmarthen's showroom



MAN'S H.P. COUP

wonder that hire-purchase are coming home to roost. A housewife, who has admitted 12,000 worth of goods held on hire, said she obtained "at least a dozen washing machines, a dozen refrigerators, a dozen spin driers" and other articles from 26 stores. The husband's simple ruse of using false names, the wife asked in Liverpool Crown Court, said such cases made him think hire-purchase laws should be tightened. The husband was also selling and taking rent on the house she lived in, which was not his own, and was sent to prison for three years.

E.E. Ladies' Evening

Seriousness was imparted to the Ladies' Evening of the Association of Supervising Electrical Engineers, by a stirring appeal for more money for exporting, delivered in the witty style by the guest of honour, Miss Hornsby-Smith, M.P. But that momentary break in an evening was as lighthearted and successful as any Christmas party as ever. Miss Smith was replying to the toast of the evening, proposed by ASEE, Mr G. C. Kitchener. She said she had Britain needed skilled electricians, trained men and women at home and at no time had she faced competition from abroad. None of the national schemes for roads and bridges would be worth the paper they were written on unless export trade was stimulated.

HOME SAFETY

The provisions of a new Home Bill presented in the House of Commons is recently is to enable certain authorities in England and Wales to enforce safety in the home and to encourage contributions to voluntary organisations whose activities consist of or include the promotion of safety in the home.

Wiring OF THE WEEK

Design of power distribution network still more of an art than a science. . . . Mr G. S. BUCKINGHAM, in his paper on "Short-Circuit Ratings of Cables."

"Let your husbands know you are a fuse. If you do, you will prevent self rewiring the house and your husband won't even be around to hold the wire." . . . MRS B. J. FINNIE, at a bilitee luncheon of West Kent I.A.W.

Construction of power stations on the coast is not universally well-regarded. . . . From a CEBG statement issued last week for nuclear stations on the East Coast.

PRICES of cable metals and other materials					
Figures quoted are the official prices ruling on Monday, December 19					
	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	236½	+2½	ZINC, virgin, min. 98% purity (cash) ...	80½	-3½
" (3 months) ...	234½	+4½	" (3 months) ...	81	-3
LEAD, refined pig. 99.97% purity (cash) ...	64	-2	RUBBER, per lb No. 1, RSS, spot ...	25½d	-½d
" (3 months) ...	65	-2	c.i.f. basis, ports, Feb. ...	25½d	-
TIN, refined, min. 99.75% purity (settlement) ...	796½	-1	ARMOURING: Galv. Steel Wire (0.104 in.) ...	68	-
" (3 months) ...	794	-1½	Mild Steel Tape (0.04 x 1½ in.) ...	53	-
ALUMINIUM, ingots 99.995% purity (settlement) ...	186	-	NICKEL (home) ...	600	-
" (3 months) ...	193½	-	MERCURY (76 lb flask) ...	69½	-1
BRASS Strip 63/37 ...	202½	-4½	AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	-
SILVER (Troy oz) ...	79½d	-	Lead. (New York) ...	11c	-1c

* Tape Price, now an average, includes varnishing

Annual check on washing machines urged

A BROKEN earth wire and the rough head of a screw were reasons for an electric washing machine becoming live, killing a 31-year-old housewife, it was stated at an inquest at Abercynon, Glam., last week. After hearing evidence, the Coroner agreed with an official of the South Wales Electricity Board, that washing machines should be checked annually to make sure the machine and installation were in perfect order.

The washing machine, which had been purchased five or six years ago, had not given any trouble, apart from the earth wire which was attached to a clip on the water pipe of the kitchen tap. The husband of the deceased, Mr Watts,

said the earth wire broke about a foot from the clip and he joined it up several times. for it always seemed to be breaking. He did not realise the significance of the earth wire.

Mr H. S. Vaughan, of the South Wales EB, said it was found that one of the live leads connecting the coils inside the motor had chafed, cutting through the insulation and touching the frame of the machine. A screw in the motor had a rough edge and, when the machine was in operation, the vibration would chafe the insulation. There was no earth connection.

A verdict of accidental death was returned.

380 at Xmas luncheon

DESPITE his early electrical engineering exploits, electricity was here to stay, Mr Norman Collins, well-known author and deputy chairman of Associated Television, said as guest speaker at the Electrical Industries Club's Christmas luncheon in London last week. The principal exploit was blacking out a village when replacing a fuse. A record 380 members and guests attended the luncheon. A collection for older Electrical Industries Benevolent Association beneficiaries realised over £130.

O.E.E.C. SUCCESSOR AGREED

FORMAL signing in Paris last week of the charter of the new Organisation for Economic Co-operation and Development (OECD) marks an important stage in the development of a successor to the 12-year-old OEEC. The new Organisation will have USA and Canada as full members, besides 18 European countries, and will have wider scope than its predecessor.

Much of the committee structure of OEEC is to be retained by the new body. However, it will add to this machinery a trade committee which will make regular examinations of general trading policies of member states.

News in Brief

Annual luncheon of the British Refrigeration Association will be held at Connaught Rooms, W.C.2, on 10 March. The Rt Hon F. J. Erroll, President of the Board of Trade, has accepted an invitation to attend.

On 1 Jan. Spain will become the fourteenth member State of CERN, the European Organisation for Nuclear Research.

The Royal National Lifeboat Institution has decided to fit Aqualite L20 automatic lights to all life-jackets used in the service. These have a silver chloride-magnesium 1½ V battery encased in plastics, the lights being automatically activated in water.

Annual general meeting of the North Metropolitan branch of the EIBA will be held at Northmet Hse, Southgate, N.14, on 9 Feb., at 3 p.m.

Dimplex Ltd. are to launch a large advertising and sales promotion campaign for their towel rails next February.

Barclays Bank is soon to take delivery of their first automatic cheque-sorting machine.

With falling sales of TV sets, the General Electric Co. is taking 140 women workers off the TV lines at its Coventry factory.

Company Activities

PERHAPS it was the thought of Christmas which at one time last week brought a little more cheer into stock markets, since certainly there was nothing in the latest trade figures and balance of payments to cause much rejoicing. None the less, over the week a gentle leavening of prices was seen to extend to the electrical share market.

It is true that the "trade gap" declined to £70 million in November from £122 million in October, but both the record export figure of £342 million and the record level of imports at £420 million were distorted as a result of the tally clerks' strike in October which then put a brake more on exports than on imports. So, if exports are taken over the three months September/November they emerge only 2% up on the previous three months, while on a similar comparison imports edged up 3½%. Further, compared with a visible trade deficit of £41 million in the third quarter of 1959 there was a deficit of £133 million in July/September, 1960. And when we look at the overall current balance of payments, which counts in earnings on "invisibles" for services rendered, etc., it is found that there was still a £101 million deficit in the third quarter of 1960 against a £43 million surplus a year before. In fact, over the first nine months of 1960 the deficit had added up to £66 million against a nine months' surplus of £159 million in 1959. Those, therefore, who have been looking for some ease in the "squeeze" will have to keep looking for some time, since until there is a marked improvement in our external earnings there just can be no let-up on the present domestic curbs.

But certainly the electrical market fared fractionally better. Thus, AEI crept up from 39s 6d to a wary 41s 3d, BICC gained 4½d at 48s 6d, E. K. Cole

went 1s dearer to 19s 7½d and Elliott-Automation scored a 1s 3d gain at 24s 1½d. After the previous week's falls both Ultra Electric and Radio and Allied Holdings made good recoveries. There were also a number of responses to specific items of company news and among the most outstanding was the 3s rise in the 10s Ordinary shares of the Plessey Co. to 47s. News from them was that their subsidiary, Garrard Engineering and Manufacturing, has secured gramophone equipment orders from the United States valued at \$1 million for delivery within the first three months of 1961. Plessey shares, now 7s below their 1960 "high" and yielding 3·6%, could easily prove a "winner" in 1961. As a guest recently in a Parisian household, I was also told that Garrard 'gram equipment is very much sought after in France. *Verb. sap!* Initially, International Computers and Tabulators also responded well to their trading results for the year and the 1½ point increase in the total dividend to 11½%. The net profit after tax is up from £1,304,000 to £1,926,000. So after starting out the week at 59s the £1 Ordinary shares, after dipping to 58s 9d, climbed to 63s 6d after the results but came back to finish business at 58s 9d.

But two of the top spots were supplied by Decca Record and EMI, whose shares spun up 3s 6d and 1s 9d to 52s and 43s 9d, respectively, on the industry's record disc sales before coming back to 51s and 42s 3d. Consumer spending this year is likely to be around £30 million—its highest ever. It might also usefully go on record for ELECTRICAL TIMES readers that EMI shares, now 28% below their top price touched earlier this year, will prove among those to star in any electrical "Hit Parade" 1961 cares to arrange.—*From our City Correspondent.*

the credit squeeze, sales of the new Chef mixer are stated to be higher than the peak levels reached in 1959.

Lloyd's Packing Warehouses (Holdings)

This group (which took over Long and Crawford last March and includes Regentone Products Ltd.) is paying a final dividend of 9%, making a total of 15% (*same*). Group net profit declined to £233,435 (£287,303) after taxation charge of £154,766 (£274,207).

Radio Rentals Ltd.

With group trading profit for the year ended 31 Aug. last increasing to £5,742,065 (from £4,917,999 in the previous year) the total dividend is also effectively raised 5%. Final dividend is 15% making a total of 20% on capital increased by a one-for-two scrip issue. Depreciation absorbs £3,439,954 (£2,968,104) this time, but taxation is £123,155 down at £728,124, leaving a net profit of £1,573,987 (£1,098,616).

Spark Holdings Ltd.

This group now has nine operating subsidiaries, with Hawke Cable Glands Ltd. and Ductwork Ltd. among the four firms in the Engineering Division. Six of the subsidiaries were acquired in the past year and Mr J. G. Lawson, chairman, has told shareholders that the expansion of the group has been financed almost entirely out of its own internal resources and even now the overall indebtedness to bankers is less than £50,000. The board propose to bring the issued capital into line with the real capital employed and as a first step suggest the writing up of the issued share capital from 1s to 2s/share, i.e., a total of £183,750. As the group nominal capital is only £300,000, this will be raised to £1 million to permit not only future capitalisations, but also to give a reserve of unissued capital for any new acquisitions.

Thorn Electrical Industries

Dealing commenced earlier this week in the £3 million newly created 6½% Unsecured Loan Stock, 1985-89. The stock was placed by Hambros Bank, with a proportion available in the market, consisting of £600,000 at £98½%. Net proceeds of the issue will be used to reduce bank overdrafts which amounted to £2,974,793 on 3 Dec. Over the past five years net profits have averaged £1,655,709 before taxation.

Dividends Declared

Cables Investment Trust. Interim 10d per share (*same*).

Combined Electrical Manufacturers. Interim is 4% as forecast at time of merger of Hackbridge and Hewitt Electric Co. and Switchgear and Cowans.

Globe Telegraph and Trust. Interim 2½d per share (*same*).

Broom and Wade Ltd.

In addition to achieving record sales and profits in the year to 30 Sept. last, this company's order book at the present time is higher than at the same period last year, Mr H. S. Broom, the chairman, reports. Chief reason for the company's greater profitability is higher turnover, accomplished by more efficient production, he adds. Capital commitments at the end of the year were estimated at £200,000, and a comprehensive scheme for the progressive replacement of all plant is under review.

Dewhurst and Partner

After all charges, including taxation, profit for the year to 30 Sept. last amounts to £124,256 (£117,390), and a final dividend of 15% again makes the total distribution 20%. Taxation charge this time is £119,397, compared with

£76,616 allowed in the previous year.

Kenwood Manufacturing Co.

Announcing an interim dividend of 7½% for the year ending 31 July next the directors state that the group profit, before tax, for the 19 months' period to 31 July, 1960 (including results of Kenwood Manufacturing (Woking) Group for a year) amounts to £42,675. Of that sum, taxation absorbs £33,282 leaving a group net profit of £9,393. When the companies were amalgamated in December, 1959, a profit of £196,000 was estimated for the period, but since then production difficulties, particularly with the mixer, have caused a decline in profits. Those difficulties have now been largely overcome and the outlook for the current year is more encouraging. Although sales of some products (such as refrigerators) have been affected by

COMMERCIAL INFORMATION

Contracts Open at Home . . .

given are the final for receipt of orders unless otherwise stated.

—**Felling B.C.** Electrical installation at St. Ann's Secondary Girls' Springfield Rd.—Advertised 1 Dec.

—**Brentwood U.D.C.** Supply of 22) lamps for year.—See 15 Dec.

—**Eastleigh B.C.** Supply of (Item 10) lighting lamps for year from 1 April, See 8 Dec. issue.

—**Scottish National Camps Assn.** al installation at Belmont Camp Meikle, Perth. Applications to 1 Manager and Secretary, 57 Melville nburgh 3, by above date.

—**Haltemprice U.D.C.** Supply of and tubes.—See 15 Dec. issue.

—**Prestwich B.C.** Supply and erec- on fixed-price basis, of 26 reinforced e columns with 24 fluorescent and dium lamps/gear along Rectory Rd concrete columns with sodium light- King's Rd, plus removal of 31 ; units.—See 15 Dec. issue.

—**Enniskillen R.D.C.** Provision of 19 ent lanterns on concrete columns and in wood poles. Engineer and Sur- A. Stephenson, Council Offices, rade. Deposit £2 2s.

—**Farnborough U.D.C.** Lighting and installations at Jubilee Hall. Engineer rveyor, Municipal Offices, Alexandra rnborough, Hants. Preference to con- on N.I.C.E.I.C. roll.

—**Denby Dale U.D.C.** Supply, erec- d wiring of 225 25 ft Stanton concrete is together with 140 W sodium lamps/ s/gear along A636 Wakefield Rd and larnsley Rd.—See 8 Dec. issue.

—**Monaghan C.C.** (b) Erection and tion of two pumping sets to deliver m. at a 106 ft head for Rockcarry . Supply and/or erection of two 42 pumps at a 128 ft head for Newbliss. l Dec. issue.

—**Shoreham-by-Sea.** Street lighting sing 13 Group "A" single arm, one arm 140 W sodium and one post-top cent lantern at High St divided; (1) of electrical equipment; (2) taking existing columns, supply/erection/ wiring of electrical equipment, of mder; (3) with electrical equipment other manufacturer. Surveyor, St. l's, Ham Rd.

—**Bacup B.C.** (a) Electrical work in uses at Tunstead Rd estate, Stack- Borough Engineer, Municipal Offices. t £2 2s.

—**Llanfyllin R.D.C.** Electrical instal- in new offices.—See 8 Dec. issue.

—**Droitwich B.C.** Supply and erection street lamps, together with lanterns/ iring.—Advertised 15 Dec. issue.

—**Romford B.C.** Supply of 200 W lamps/lanterns/gear/brackets for con- of 69 existing units.—See 15 Dec.

—**Romford B.C.** Tender M26. Supply ps for year.—See 15 Dec. issue.

—**Saundersfoot.** Wiring of village hall. from Major E. Molyneux, Langdale, ers Rd, Saundersfoot.

—**Manchester C.C.** Provision of road ir park mercury vapour lighting at ester Airport.—See 15 Dec. issue.

—**Radcliffe B.C.** Supply and instal- of 43 140 W sodium lamps on 25 ft is and brackets, plus removal of 28 ; units along A667, Ringley Rd.—See issue.

—**Manchester C.C.** Electrical services tion in Central Technical College, ester 15.—See 15 Dec. issue.

5 Jan.—**Belfast C.C.** (a) Electrical installa- tion in Fane St Secondary School.—See 8 Dec. issue.

5 Jan.—**Staines U.D.C.** Fixed-price basis: Supply, fitting and erection of Class "A" steel columns with 168 mercury fluorescent and 15 fluorescent lanterns, lamps, gear and ancillary work. Engineer and Surveyor, Shortwood Hse, 240 London Rd. Deposit £2 2s.

5 Jan.—**Belfast C.C.** (a) Supply of condenser tubes and (b) supply and erection of 25 kW germanium diode r. tifier sets (Specifications W184 and 5, respectively).—See 8 Dec. issue.

6 Jan.—**Blackpool B.C.** Supply of lamps for year to 31 March, 1962. Director of Lighting and Electrical Services, Rigby Rd East.

6 Jan.—**Camberwell B.C.** Supply of (Item k) lamps and (Item s) cables, conduit and fittings.—See 15 Dec. issue.

6 Jan.—**Cardiff C.C.** Erection, on fixed-price basis, of 18 30 ft metal, 20 25 ft concrete and metal and 400 Class "B" concrete columns, 180 trolley pole brackets, 35 catenary suspended lanterns and installation of 200 W and 140 W sodium and 80 W and 400 W mercury lamps/gear. City Sur- veyor, City Hall. Deposit £2 2s.

6 Jan.—**Kilkeel.** Electrical installation in Holy Cross Primary School.—See 15 Dec. issue.

6 Jan.—**Wanstead and Woodford B.C.** Supply of (Item 13) for year.—See 8 Dec. issue.

6 Jan.—**Wood Green B.C.** Supply of (Item 17) lamps.—See 15 Dec. issue.

7 Jan.—**Baldock U.D.C.** Supply and erec- tion of 11 25 ft concrete columns with 140 W sodium lighting.—See 15 Dec. issue.

7 Jan.—**Bath C.C.** Supply of (Item 40) i.v. cables; (41) discharge lamps; (42) tungsten lamps and fittings; (43) steel and concrete columns; (44) street lighting lanterns; (45) control gear and capacitors; (46) time switches, for year.—See 8 Dec. issue.

7 Jan.—**Dagenham B.C.** Supply of (Item 31) lamps for year.—See 15 Dec. issue.

9 Jan.—**Skipton U.D.C.** Rewiring of 83 pre- war houses, Shortbank Rd. Engineer and Surveyor, Town Hall. Deposit £2 2s.

9 Jan.—**Swansea B.C.** Two disintegrator sets pipes, valves, control gear, switches, switch- board, etc., for Limeslade Sewerage Scheme.—See 15 Dec. issue.

9 Jan.—**West Lanes R.D.C.** (a) Supply of 55 Class "A" and 527 Class "B" concrete columns/brackets; (b) supply of 140 W sodium and M.F. Class "B" lamps/lanterns/

transformers/capacitors; (c) erection of columns/brackets, fitting and wiring of elec- trical equipment and commissioning plus removal of redundant equipment. Engineer and Surveyor, Council Offices, Derby St, Ormskirk. Deposit £2 2s.—Advertised in this issue.

10 Jan.—**Dunblane B.C.** Supply and erection of seven Group "A" concrete columns/lan- terns/auxiliary equipment, plus the resiting of six columns along A9.—See 10 Nov. issue.

10 Jan.—**Hebburn U.D.C.** Electrical instal- lations in 42 houses in central area rede- velopment scheme. Surveyor.

11 Jan.—**Blyth.** Supply of (Item 15) cables and fittings for year to 31 March, 1962. Borough Engineer, Municipal Bldgs.

11 Jan.—**Tonbridge R.D.C.** Wiring, by regis- tered contractors, of Council Offices and proposed extension.—See 15 Dec. issue.

12 Jan.—**Westminster C.C.** Supply of lamps for year from 1 April, 1961. Applications, enclosing 14 in. by 10 in. s.a.e., to Town Clerk, City Hall, P.O. Box 141, W.C.2.

13 Jan.—**Malden and Coumbe B.C.** Pro- vision of Group "A" 200 W sodium and fluorescent lighting schemes with tubular steel columns. Borough Engineer and Sur- veyor: J. Apse, Municipal Offices, New Malden.

14 Jan.—**West Lothian C.C.** Supply and erection of 25 200 W long type sodium lanterns on 35 ft steel columns/brackets along A8, near Bangour Hospital. County Electrical Manager, 212 High St, Linlithgow.

16 Jan.—**Bermondsey B.C.** Supply of lamps for year.—See 8 Dec. issue.

16 Jan.—**Birmingham Tame and Rea.** Three 1,500 g.p.m., two 140 g.p.m. and three 70 g.p.m. centrifugal pumps complete with motor control gear. District Drainage Board Engineer, Rookery Park, Erdington, Bir- mingham 24.

16 Jan.—**Prestwich B.C.** Supply of (Item 10) lamps for year to 31 March, 1962. Borough Engineer, Town Hall.

17 Jan.—**Newcastle upon Tyne C.C.** Supply and installation of two automatic passenger lifts in each of two 15-storey blocks of flats at Longbenton Estate.—See 8 Dec. issue.

28 Jan.—**Camborne-Redruth U.D.C.** Supply of (Item 24) electrical equipment and fittings for year.—See 8 Dec. issue.

28 Jan.—**Rhyl U.D.C.** Supply and instal- lation complete of: (a) two 1,560 g.p.m. sewage pumps, two 8,250 g.p.m. and two 12,450 g.p.m. storm water pumps with

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 110 queries answered this week

"Westminster" electric blankets— address for? C.C.—Norrard Ltd., 62 Clayton La, Bradford 5.

Easy Washer Co., of Toronto—agents for? S.E.E.B.—Metalcraft Mngf. Co. (Canada) Ltd., 37 Berners St, W.1.

"Silent Giant" hairclippers—makers of? E.E.B.—Wahl (England) Ltd., 215 Putney Bridge Rd, S.W.15.

"Kerson" switches—address for? T.E.—Midland Electric Mngf. Co. Ltd., Reddings La, Tyseley, Birmingham 11.

"SnowWhite" clothes driers—makers of? E.W.—J. Glover and Sons Ltd., Groton Rd, Earlsfield, S.W.18.

"Planet" lampshades—makers of? D.W.—Planet Shades Ltd., 14a Manor Rd, N.16.

"Dorset" refrigerators—makers of? L.E.B.—Dorset Refrigeration Ltd., Lake Rd, Hamworthy, Poole, Dorset.

"Isnet" fan heaters—suppliers of? E.S.—Wynbourne Electrical Products Ltd., 90-96 City Rd, E.C.1.

"Minibar" trunking systems—makers of? A. and P.—Bill Switchgear Ltd., Aston La, Perry Barr, Birmingham 20.

ANSWER WANTED

"Rotostat" starter gear—makers of? T.B.—

motors, starters, pipework, valves, etc.; (b) one 800 b.h.p. stand-by diesel-alternator (alternatively, supply only of diesel-alternator). Engineer and Surveyor, Council Offices. Deposit (a) £5 and (b) £3.

1 Feb.—Oxford T.C. Supply and erection of two high-lift 3,500 g.p.m. and two low-lift 3,850 g.p.m. pumps complete with motors, switchgear and cabling.—See 10 Nov. issue.

No date stated.—Loch Lee Water Board. Supply and installation of switchboards, wiring, lighting and heating installations for first phase Loch Lee scheme.—See 15 Dec. issue.

No date stated.—North of Scotland H.E.B. Supply and erection of 132 kV steel tower double circuit spur line to Burghmuir.—Advertised 8 Dec. issue.

... and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

28 Dec.—America. 500 kV, l.t. substation, duplex control centre, distribution board, battery chargers, etc. District Engineer, U.S. Army Engineer District, 628 Pittcock Block, Portland 5, Oregon. B.o.T. (ESB/31999/60).*

28 Dec.—Burma. 1,470 rolls (25 yd) 2 in. wide black adhesive insulating tape. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/32471/60).*

28 Dec.—Burma. One gross 24 V 15 W s.b.c. lamps, 30 gross 110 V 60 W b.c. lamps, 60 gross 230 V 75 W b.c. lamps. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/32475/60).*

30 Dec.—Burma. Accessories, lighting fittings, fans, switchgear, switch and distribution boards for new Intermediate College Project, Thamaing. Documents, fee £3 15s 9d, from Burmese Embassy, 76 Cadogan Sq, S.W.1. B.o.T. (ESB/32421/60/ICA).*

5 Jan.—America. Two 83,333 kVA, 13.8 kV,

225 r.p.m. vertical shaft hydraulic alternators for Spring Creek Plant. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/31977/60).*

9 Jan.—India. 24 testing instruments. Chief Engineer (South), Stores Purchase Section, The Mall, Patiala. B.o.T. (ESB/31908/60).*

13 Jan.—India. Enquiry SE 279. Cooling towers for D.V.C. Chandrapura Thermal Power Station. Documents, fee £1 1s 5d, from Co-ordination Branch, India Store Dept., Bromyard Ave, W.3, viewing reference S.3844/60/NSC/ENG.2.

13 Jan.—S. Africa. 10 MVA transformers and gear for Springs T.C. Consulting engineer: J. S. Clinton, P.O. Box 4648, Johannesburg. B.o.T. (ESB/31961/60).*

15 Jan.—Burma. Five-ton o/h travelling crane for foundry duty. Deputy Assistant Director-General, Procurement Branch, Ind. Development Corp., 243-251 36th St, Rangoon. B.o.T. (ESB/32365/60).*

15 Jan.—Kuwait. (1) Three 5 MVA 33/11.5 kV oil immersed natural cooled transformers and (2) 500 yd 11 kV 0.4 sq in. single-core p.i.c.s. cable. Dept. of Electricity, Water and Gas. B.o.T. (ESB/31813/60).*

21 Jan.—Iran. 25 kW diesel generators. Imperial Iranian Navy, Tehran. B.o.T. (ESB/32310/60).*

25 Jan.—India. Switchgear for Kiriburu substation, etc. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/29421/60).*

26 Jan.—New Zealand. 750 rubber cased torches. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/31992/60).*

9 Feb.—Australia. 1 to 10, 11 to 20 1.5 kVA s.-ph., 1 to 5 6 kVA s.-ph. and 1 to 5 6 kVA 3-ph. diesel alternators. Controller, Stores and Contracts, Postmaster-General's Dept., 114 Russell St, Melbourne C.I. B.o.T. (ESB/32482/60).*

14 Feb.—New Zealand. Four s.-ph. 3.333 MVA outdoor oil immersed transformers, alternatively two 3-ph. 10 MVA transformers. Secretary, Tenders Committee, New Zealand Electricity Dept., Wellington. B.o.T. (ESB/31439/60).*

16 Feb.—Australia. Electron tubes, 132 items. Controller, Stores and Contracts, Postmaster-General's Dept., 114 Russell St, Melbourne C.I. B.o.T. (ESB/32356/60).*

27 Feb.—India. Winding machines, ovens, impregnating plant, brazing and soldering machines. Shri D. P. Guzdar, Officer on Special Duty, Heavy Electricals Ltd., Crown Hse, Aldwych, W.C.2. B.o.T. (ESB/31972/60).*

28 Feb.—Argentina. 150 double-bogie trams (new or second-hand). Transportes de Buenos Aires, Seccion Licitaciones, Bme. Mitre 3345, Buenos Aires. B.o.T. (ESB/32324/60).*

CONTRACTS PLACED

C.E.G.B. Contracts placed during the past month amounting to £13,400,000 include: Blyth B power station: two 350 MW turbo-generators, feed water heating plants, boiler feed pumps and auxiliaries, English Electric Co. Ltd.; 415 V switchgear, contactors and accessories, M. and C. Switchgear Ltd. Thorpe Marsh power station: high pressure pipework and valves for No. 1 generator and No. 1 boiler, Aiton and Co. Ltd. Rugeley power station: auxiliary control and instrument cables and accessories, N. G.

Bailey and Co. Ltd. Hams Hall A power station: 15 MW Olympus powered gas turbine generating plant, Bristol Siddeley Engines Ltd. Drakelow C power station: main foundations, J. L. Kier and Co. Ltd.; circulating water pumps, Drysdale and Co. Ltd.; circulating water valves for sets 9 and 10, Guest and Chimes Ltd.; circulating water valves, J. Blakeborough and Sons Ltd.; coal handling plant, International Combustion Products Ltd.; high pressure pipework and valves for units 9 and 10, Babcock and Wilcox Ltd. Staythorpe B power station: No. 2 cooling tower, Davenport Engineering Co. Ltd. West Thurrock power station: generator transformers Nos. 3 and 4, Associated Electrical Industries Ltd.; reinforced concrete coal reclaim bunkers, Bierrum and Partners Ltd.; mobile coal handling plant for units 1 and 2, John Blackwood Hodge and Co. Ltd. Bankside power station: flue gas-washing plant, Head Wrightson Processes Ltd. Paddington substation: two 66/22 kV, 45 MVA transformers, Ferranti Ltd. Brimsdown substation: 33 kV switchgear modifications, Associated Electrical Industries Ltd. Carrington substation: 132 kV air blast switchgear, Associated Electrical Industries Ltd. Lancaster substation: two 132/33 kV, 45 MVA transformers and auxiliaries, C. A. Parsons and Co. Ltd. Corby substation: 275 kV switchgear, Associated Electrical Industries Ltd.; 132 kV switchgear, General Electric Co. Ltd. Taunton substation: 132 kV switchgear, Associated Electrical Industries Ltd. Skelton Grange B power station: 132 kV switchgear, Associated Electrical Industries Ltd. Whitson substation: 33 kV switchgear, A. Reyrolle and Co. Ltd. Harker-Penwortham: second circuit 275 kV overhead line, Watshams Ltd. Sundon substation: 132 kV cables, Pirelli-General Cable Works Ltd.

TRADE NOTES

Changes of Address. The Sales Departments of G. A. Harvey and Co. (London) Ltd. are now operating from Villiers Hse, Strand, W.C.2. Telephone: Whitehall 9931. Early in the new year the company will open a London showroom in the new building.

The London office of Matthew Hall and Co. Ltd. is now at 101-108 Tottenham Court Rd, W.1. Telephone: Museum 3676. The factory and stores remain at 1-4 Amberley Rd, W.9.

New Depots. Davis and Timmins Ltd. have established a new depot on the Bridgend Trading Estate.

The new Norwood Rd, Birmingham, depot of Oldham and Son Ltd. was officially opened last week.

Change of Name. The title of the Radio Rentals' subsidiary, Mains Radio Gramophones Ltd., has been changed to Baird Television Ltd.

New Telephone No. The telephone no. of the Leicester sales office of Brook Motors Ltd. is now Leicester 50781.

Agent. Armourdout Trading Co. Ltd., 1-3 Brixton Rd, S.W.9, have been appointed London agents to Swifts of Scarborough Ltd. for their cable trunking and components and cable trays.

Agreement. Marconi Instruments Ltd., under a recent agreement with Computer-Measurements Co., of Sylmar, California, will manufacture CMC's range of transistorised electronic counters, and have world selling rights outside North America and Japan.

Expansion. H. W. Field and Son Ltd. have purchased the former T.A. Drill Hall at Southwold to utilise as a branch factory.

REAMA Contract Price Adjustment Formulae. For Electrical Machinery and

Equipment. For purposes of calculating variations in (a) "Rates of Pay"—the rate of pay for adult male labour at 16 Dec., 1960, shall be deemed to be 204s 6d; (b) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 16 Dec., 1960, is 116.4* (180.6*).

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (a) "Rates of Pay"—the rate of pay for adult male labour at 16 Dec., 1960, shall be deemed to be 204s 6d; (b) "Cost of Material"—the index figure for materials used in the Mechanical Engineering Industry at 16 Dec., 1960, is 126.0* (189.3*). "Blast Furnaces and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)," 189.5*. Other Steel Goods, excluding tubes (1958 S.I.C. ref. 311/2), 129.1*. The price of brass condenser tubes 1 in. o/d 18 s.w.g. on 16 Dec., 1960, is 4s per lb. *Provisional figure.

The figures in parentheses shown above relate to earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954=100.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Homelight. 804,181. Class 7. Machines for domestic use. Pye Ltd., Radio Wks, Cambridge.

Invalift. 807,850. Class 7. Apparatus for lifting and carrying invalids. Electrical Productions (Leeds) Ltd., Hope Rd, Mabgate, Leeds 9.

Memopark. 798,031. Class 9. Time switches, meters, etc. Venner Ltd., Kingston By-pass, New Malden.

Metrac. 803,777. Class 9. Testing or measuring instruments. Everett Edcumbe and Co. Ltd., Colindale Wks, N.W.9.

Novotherm. 804,826. Class 9. Instruments, etc. Thermocontrol Installations Co. Ltd., 2-10 Valentine Pl, S.E.1.

BUSINESS PROSPECTS

Wessex Regional Hospital Board. ster, plan £25,581 Stage 2a of Lord Treloar Hospital extensions.

British Geon, Devonshire Hse, r Pl, W.1, plan major expansion of al plant.

ord T.C. School and training college l at former Laxton nurseries. En-Geo. Wimpey plan development of Laxton nurseries as private 400-house with shops.

st. Young and MacKenzie, 2 Wellington, Belfast, architects for the Scottish s' Fund and Life Assurance Society building on site at junction High ibard St.

om U.D.C. Tender: 50 terraced, North Rd, Boldon Colliery. Sur-

om. Goodyear Tyre and Rubber Co., ury, Wolverhampton, plan tyre re-factory buildings at Manchester Rd ial estate.

om T.C. 58 houses and 20 bungalows d. Surveyor.

remouth. Richmond Hill Printing plan factory extension, 23 Abbott J. Drake and Son, Orchard St, remouth, plan Wallisdown Rd factory. sex Regional Hospital Board, Win-; plan maternity unit at Firs Hospital. ctors: Jenkins and Sons, 43 Holden-ld.

lington. Rigg Holdings plan factory ion.

aley. Peter Nuttall, 5 Kay St, Rawten-architect for St. Hilda's R.C. Secondary extensions, phase 2.—Joseph Lucas l million Eastern Ave factory. Tee and 43 Frederick Rd, Birmingham 15, cts.

diff. Corporation Development Com- plan experimental flattened factory near ntre.

shalton. Surrey C.C. plans £50,000 old s' home at Wandle Mead. Architect. tham. Farms and Ptnrs, 24 Welbeck W.1, architects for printing works ing offices and stores at 12 New Rd for Parrett and Neves.

sterfield U.D.C. 12 bungalows planned ew Rd estate and block of bed-sitting flatlets for old people. Surveyor.

sterfield T.C. Civil Defence head- ers and social centre to cost £20,000 ed for rear New Sq. Surveyor.

ingford B.C. Tender: 16 flatlets. En-

ilville. H. Owen Luder, 79 Regency W.1, architect for £½ million shopping : for Triland (Property Holdings). chester. £7,300 stage 7 of street lighting ument planned.

rlington. H. B. Richardson, 3 Skinner-Darlington, architect for North of nd Newspaper Co.'s workshops and s at Priestgate.

ncaster T.C. Wholesale fruit and vege- market planned. Surveyor.

dley. Clydesdale Stamping Co., Atlas Netherton, plan Yew Tree Hills dye

rhams. Sir Basil Spence, 1 Canonbury l.1, architect for £400,000 new women's e, St. Aidan's.

ling. Middlesex C.C. plan £20,000 Old- and Woodend community centre.

lington. R.D.C. plan £7,528 improve- of electrical facilities to cover 2,000 s.

wt B.C. Tender: 39 bungalows, "High-" Bagillt. Engineer.

asnow. Walter Underwood and Ptnrs, Belle Pl, Glasgow C.3, architects for 000 two-storey store at Argyle St for ison's Associated Companies.

sport B.C. Tender: 24 one-bedroom Water Police Quarters site, Trinity n. Engineer.

Grimsby T.C. Two three-story flats block planned junction Bath St Albion St, £32,091. Engineer.

Haltwhistle. Benson and Dixon, Fairhill, Haltwhistle, contractors for Smith and Walton's planned factory additions.

Hampshire. C. G. Stillman, 4 Fitzroy Park, N.6, architect for C.C.'s comprehensive health clinic, ambulance station, community centre, library and flats, probably at Havant.

Herefordshire. E.C. plans £½ million gram- mar school near Fayre Oaks Cottage, King's Acre La.

Hounslow. Gula Investments plan six- storey office block with 35 ground floor shops on High St site.

Hull. F. Bilton, 83 Wincolmlee, Hull, contractors for £400,000 Kingston upon Hull Training College, Cottingham Rd.—J. H. Fenner and Co., Marfleet, Hull, plan re-search and development block, Marfleet Ave.—Reckitt and Sons plan additional floor to offices, Kingston Wks, Danson La.

Ipswich B.C. Tender: Stage 1, new secondary modern school, Chantry estate. Architects: Johns, Slater and Haward, 32 Foundation St, Ipswich.

Kettering. T. Wilson and Son, Sheep St, Northampton, plan 35 dwellings on housing site at Hall La.

Knaphill. New Ideal Homesteads, 61 South St, Epsom, Surrey, plan 260 houses at Hermitage and Inkerman roads.

Leamington Spa. Lewis and Watters, Lime Ave, plan 57 Parklands Ave houses.

Leeds. Jowett and Sowry, Albion St, plan £125,000 printing works, etc., Shannon St area. Architect: G. Alen Burnett, 8 Blenheim Terr, Leeds.

London. T. P. Bennett and Son, 43 Bloomsbury Sq, W.C.1, architects for 15-storey ward block at London Hospital, East Mount St, Stepney, E.1.—George Trew and Dunn, 50 Eastbourne Terr, W.2, architects for extensions of King's College Hospital, Denmark Hill, S.E.5.—Scherrer and Hicks, 27 Harcourt Hse, Cavendish Sq, W.1, architects for £443,000 reconstruction of Tudor Secondary School, Islington.—York, Rosenberg and Mardall, 2 Hyde Park Pl, W.2, architects for extensions to Southlands College, Wimbledon Park Side, S.W.19.—F. J. Broadbent and Ptnrs, 13 Manchester Sq, W.1, architects for Our Lady of the Rosary Convent in Crawford St. Cost: £150,000.—Maurice Sanders, 24 Harley St, W.1, architect for 19-storey office building with shops, restaurant, etc., on sites in London Wall, Winchester Ave, Wood St, etc., E.C.2.—A. Kenneth Lindy, Joseph Hill and Ptnrs, 24 St. Mary Axe, E.C.3, architects for six-storey office building, St. Mary Axe and Bevis Marks, E.C.—T. P. H. and E. Braddock, Orchard Hse, 14 Gt. Smith St, S.W.1, architects for multi-storey office building, Holborn Viaduct and Snow Hill.—R. Seifert and Ptnrs, 34 Red Lion Sq, W.C.1, architects for offices at 6 and 9 Rood La, E.C.—A. F. Westman, Cheapside, E.C.2, architect for nine-storey office building at 125 Wood St, etc., E.C.2.—Audley Properties, 1 Stanhope Gate, W.1, plan 13-storey block of studio flats, 38 Abercorn Pl, N.W.

Luton. H. F. Scriven, Bute St, Luton, plan workshop and offices, Duke St.

Lytham, Lancs. W. C. Evans and Co., Chadwick Rd, Eccles, Lancs, plan factory on part of former R.A.F. Camp, near Warton. Architects: Scherrer and Hicks, Harcourt Hse, Cavendish Sq, W.1.

Maldstone. New Thornhill Estates, Foley Hse, Sittingbourne Rd, plan three-storey block of 21 flats, Park Ave.—Manor Hall Ltd. plan 108 bungalows off Queen's Rd.

Manchester. Isaac Neild Co., 47 Market St, Manchester 1, plan 20 three-storey maisonnettes, Palatine Rd.—24 flats planned, Wilmslow Rd, Withington, by P. Hamer, Swinton, Manchester.

Mansfield. V. G. Yeomans, Westbank Ave, Mansfield, plan 37 Highfield Ave bungalows.—Scientific Building Contractors Ltd., Quarrydale Rd, Sutton-in-Ashfield, plan 25 houses and bungalows, Fairholme Drive.

March. Cromwell Development Co., Coventry, plan development of six-acre site near Badgeney Rd estate for 72 private houses and five shops.

Merseyside. Metal Box Co., Baker St, W.1, plan £1 million packaging factory on Wirral 15-acre site.

Milford Haven. Davis Estates, 346 Kilburn High Rd, N.W.6, plan 76 dwellings, Bunkers Hill estate.

Mitcham. J. F. Farquharson and Ptnrs, 34 Queen Anne St, W.1, structural consulting engineers for Shirley and Warbey Box Co.'s Christchurch Rd premises.

Newcastle. S. Maclean and Co., Hadrian Wks, Heaton Rd, plan extensions.—Educational Committee. Tender: Alterations and additions to Middle St Technical High School. Education Architect.—T.C. plan 125 houses, 12 flats and garages on Newbiggin Hall estate at £267,640 and £10,680 pavilion on King George playing field, Fenham.

New Mills. Rowlinson Construction Ltd., 249 London Rd, Hazel Grove, South Reddish, plan 142 dwellings, Mellor Rd.

Nottingham. Roman Catholic teachers' training college planned at £½ million.

Oakengates. Gasel Ltd., Leonard St, Oakengates, plan factory extensions.

Oxford. Hospital Board, Banbury Rd, Oxford, plan £100,000 sick admission unit at Borocourt Hospital. Architects: Powell and Moya, 36 Gt. Smith St, S.W.1.

Peterborough. F. Perkins Ltd. plan extensions to Oxney Rd factory.—J. P. Hall and Sons plan extensions to Queen's Walk factory.

Plymouth. T.C. plans £22,000 Burrington factory for Cluett Peabody and Co.

Portsmouth. J. Cockerill and Son, 67 Commercial Rd, Portsmouth, plan £100,000 factory, St. George's Sq.

Sheffield. Hadfield, Cawkell and Davidson, 17 Broomsgrove Rd, Sheffield 10, architects for University's £390,000 third men's hall of residence.—Adams, Holden and Pearson, 38 Gordon Sq, W.C.1, architects for seven-storey radiotherapy centre, Whitham Rd, Broomhill.—Robert Neill and Co. (Sheffield), 28 Trippett Ln, Sheffield 1, plan offices on 598 sq yd site at Scotland St and Solly St.

Slough B.C. Tender: 236 dwellings, Parlant Park, Langley. Engineer.

Staines. Kelvin Construction Co., Long Drive, Greenford, Middx, contractor for £100,000 research laboratory at The Causeway, Staines, for Petters Ltd.

Stevenage. Farmer and Dark, Romney Hse, Tufton St, S.W.1, architects for £1 million factory for Bowater Paper Corporation Ltd.

Stockton-on-Tees. P. R. Middleton and Ptnrs, 111 Albert Rd, Middlesbrough, architects for £130,000 grammar school for Durham Diocese.

Torquay. Selectrics and Colmechs, Meter Hse, Factory Row, Castle Circus, Torquay, plan factory and offices, Fore St.

Wallingford. Ministry of Works (Arch- itects' Dept., Abell Hse, John Islip St, S.W.1) plan £200,000 extensions at Hydraulic Research Laboratories.

Watford. M. of Works plan £300,000 physics group buildings at D.S.I.R. Building Research Station, Watford.

Widnesbury. £1,800 Oxford St street lighting added to 1961-62 programme.

West Bromwich B.C. Tender: 184 maison- nettes. Architect.

Wilton, Wilts. Installation of street lighting to serve further development at Seagrims estate planned.

Windon B.C. Provision of traffic signals planned at Grove Rd/Groundwell Rd.

Wrexham B.C. Tender: (a) 66 dwellings, Montgomery Rd; and (b) 14 dwellings, Lorne St/Park St. Surveyor.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Abex Heating and Electrical Engineers Ltd., 59 Aylesbury St, Bletchley. Nom. cap.: £100. Dirs.: Leslie S. Hall and Cyril B. Coley.

Bendix Ericsson U.K. Ltd. To acquire the Instrument Division of Ericsson Telephones Ltd., as manufacturers of and dealers in electronic, electrical, nucleonic, mechanical, optical and hydraulic articles, components, systems, etc. Nom. cap.: £100,000. Dirs.: John H. Mitchell, 35 Lucknow Drive, Nottingham; Eric G. Monk, 15 De Vere Gdns, W.8; John H. Reed and Charles C. Tillinghast.

A. E. Bloore Ltd. To take over business of an engineering or electrical manufacturers carried on at Llanbedr by A. E. Bloore, etc. Nom. cap.: £5,000. Dirs.: Albert E. Bloore and Marjorie Bloore, Erw Fair, Llanbedr.

T. A. Boxall and Co. Ltd., 20 Balcombe Rd, Horley, Surrey. Electrical contractors, etc. Nom. cap.: £10,000. Permanent dirs.: Thos. A. Boxall and Elizabeth M. Boxall.

B.S.R. (Monarch Electric) Ltd. Electrical and general engineers, etc. Nom. cap.: £50,000. Dirs.: Daniel M. McDonald, Hammer Hill, nr. Bridgnorth, Salop; and Wm. L. Hewitt, Cedars Ave, The Paddock, Kingswinford, Staffs.

Datasonde Ltd. Instrument, electronic, electrical and mechanical engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: J. S. Camp, 239 Holland Rd, Clacton-on-Sea; and D. B. J. Stevens, 36 Hatherley Rd, Sidcup.

Electric Appliances (Swansea) Ltd., 18a Castle St, Swansea. Nom. cap.: £100. Dirs.: Derek B. G. Wignall and Derek Dawson.

Electrosil Ltd. Importers and exporters of and dealers in and manufacturers of glass, glassware, glass products, etc. Nom. cap.: £25,000. Dirs.: not named. Subs.: Peter H. D. Ryder and Kenneth H. Chapman, 15 Curzon St, W.1.

El-Tronics Co. (Gt. Britain) Ltd., 22 Queen St, E.C.4. Manufacturers of and dealers in electronic and electrical components, etc. Nom. cap.: £1,000. Dirs.: Paul M. Kovany and Stuart J. Myers.

Ensolder Iron Co. Ltd., 9 Liverpool Gdns, Worthing. Electrical contractors and engineers, etc. Nom. cap.: £100. Dirs.: Reginald G. Rhode-Knight and Margaret Rhode-Knight.

Etablissements Hoover Societe Anonyme. British address: Perivale, Greenford, Middx. Registered in Republic of France in 1953, to manufacture and sell mechanical or electrical apparatus, etc. Capital: 600,000,000 francs. Name of person authorised to accept service: Harold G. Meads, Perivale, Greenford, Middx.

Fennells Electrical Ltd., 31 Queens Rd, Nunaton, Warwicks. Manufacturers of and dealers in radio apparatus, etc. Nom. cap.: £5,000. Dirs.: Walter W. Fennell and Geoffrey J. Fennell.

J. and M. Greenwood Ltd., 367 Abergyle Rd, Old Colwyn, Denbighshire. Electrical engineers, etc. Nom. cap.: £2,000. Dirs.: Maurice A. Greenwood, Charles Randle, Joan K. Greenwood and May G. Randle.

W. Groves Ltd., 9 Edward Rd, Birmingham 12. To take over the business of manufacturing electrical engineers carried on at Balsall Heath, Birmingham 12, by W. and Mrs F. I. Groves, etc. Nom. cap.: £3,000. Dirs.: Wm. Groves and Mrs F. I. Groves.

Tayfas Developments Ltd. To carry on

business of civil, mechanical, electrical and general engineers, etc. Nom. cap.: £100. Dirs.: not named. Subs.: John O. W. Flood, 3 Vine Hse, Hampton Court Rd, Molesey, Surrey; and Angus H. Taylor, 15 Wavendon Ave, W.4.

Tele-Electric Wiring Ltd., 72 Leighton Rd, Ealing, W.13. Nom. cap.: £1,000. Dirs.: Reginald E. Sarro, John V. Sims and Leonard E. Sims.

A. J. Whetton Ltd. Electrical engineers, etc. Nom. cap.: £6,000. Dirs.: to be appointed by subs. Subs.: Arthur J. Whetton, 7 Fair Oak Drive, S.E.9; and Harry S. T. Penning, 15a Winchester Ave, N.W.6.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

G.D.S. Rentals Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 16 Jan. Persons intending to appear to notify Kinch and Richardson, 180 Fleet St, E.C.4, by 1 p.m., 14 Jan.

Albert Miller and Co. (Southport) Ltd. Petition for winding-up to be heard before the County Court of Liverpool, Fifth Floor, India Bldg, Water St, on 6 Jan. Persons intending to appear to notify Cuff Roberts and Co., 34 Castle St, Liverpool 2, by 6 p.m., 5 Jan.

R. Summers (Devon) Ltd. Mr R. A. Hawken, Bank Chmbrs, 1 John St, Bedford Row, W.C.1, and Mr G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, appointed liquidators at extraordinary general meeting on 28 Nov.

E.W.D. (Electrics) Ltd. Mr P. Cardwell, 93 Queen St, Sheffield 1, appointed liquidator as from 7 Dec.

Pearl Industries Ltd. Creditors to send details to liquidator: P. R. Hackett, 18 Greenfield Cres, Birmingham 15, by 15 Jan. Formal notice: all creditors to be paid in full.

Ice Queen Refrigerators Ltd. Meeting of creditors to be held at offices of Radford, McColl and Co., 12 Portland St, Southampton, on 22 Dec., at 2.30 p.m.

United Sewing Machines (Mayfair) Ltd. General meetings of members and creditors to be held at offices of S. G. Banister and Co., 15 Golden Sq, W.1, on 5 Jan., at 11.45 a.m. and 12 noon, respectively.

Arthur C. Symons Ltd. Mr T. J. Woods, 39 Hermitage Rd, Hitchin, Herts, appointed liquidator at extraordinary general meeting on 25 Nov.

Fenn Electrical Ltd. Mr R. A. Hawken, Bank Chmbrs, 1 John St, Bedford Row, W.C.1, and Mr G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, appointed liquidators at extraordinary general meeting on 28 Nov.

Pool Electrics (Blackpool) Ltd. Mr J. L. Hague, Bank Chambers, 7 South King St, Blackpool, appointed liquidator at extraordinary general meeting on 17 Nov. for the purpose of voluntarily winding-up.

Leslie's Electricals Ltd. Mr. H. I. Tibury, 112 Crescent Rd, Reading, appointed liquidator at extraordinary general meeting on 14 Nov. for the purpose of voluntarily winding-up.

Ideal Electrics (Middlesbrough) Ltd. Mr. R. W. Hellyer, Brotherton Chambers, Westgate, Leeds 1, appointed liquidator as from 18 Nov.

Leamington Electrical Installations Ltd. Mr. R. F. Bendall, 126 Colmore Row, Birmingham 3, appointed liquidator at extraordinary general meeting on 21 Nov. for the purpose of voluntarily winding-up.

Don Electrical Co. Ltd. Creditors to send details to liquidator: P. Cardwell, 93 Queen St, Sheffield 1, by 31 Dec.

Treforest Electrical Services Ltd. General meeting to be held at offices of South Wales Switchgear, Blackwood, Mon, on 30 Dec., at 10.30 a.m., for the purpose of having an account of the winding-up laid before the members.

H. V. Colman and Co. (Electrical Contractors) Ltd. Liquidator: W. Le'Resche Hand, Colmore Hse, 21 Waterloo St, Birmingham 2, released as from 21 April.

Mead and Jeffery Ltd. Mr R. A. Hawken, Bank Chmbrs, 1 John St, W.C.1, appointed liquidator as from 23 Nov.

BANKRUPTCY ACTS

Receiving Orders

Bridgwater. L. A. James, radio and electrical engineer, carrying on business as Domestic Electrics, at 42 Clare St. Receiving order dated 8 Dec.

Nottingham. T. K. Underwood, radio, television and appliance retailer, formerly carrying on business in partnership as Fourways Electrical Services, at 68 Carter La, Mansfield, and 18 Market Pl, Shirebrook. Receiving order dated 9 Dec.

Macclesfield. C. Powell, electrical engineer, carrying on business as Cooke and Co, at Station Rd, Wilmslow. Receiving order dated 6 Dec.

Oldham. A. Myers, salesman and electrical appliance mechanic, of 102 Greenwood St. Receiving order dated 7 Dec.

Public Examinations

Edmonton. L. Smith, electrical retailer, carrying on business as Smiths Electrics of 134 Chase Side, Enfield. Public examination: 10.30 a.m., 21 Feb., at Court Hse, Fore St, N.18.

Leeds. J. W. McEvoy, electrical appliance dealer, carrying on business as Domestic Electrics at 246 Easterly Rd, Leeds 8. Public examination: 10.30 a.m., 14 Feb., County Court Hse, Albion Pl, Leeds 1.

Application for Discharge

High Court of Justice. G. W. May, electrician, formerly carrying on business at 24 First St, Chelsea. Order made, on 4 Nov., on application for discharge: Discharged as from 4 Nov., 1961.

Rescinding Order

Rochester. C. E. Purcell, electrical contractor, formerly carrying on business as E. Purcell and Son, at 13 Wrotham Rd, Gravesend. Rescinding order dated 17 Oct.: all debts paid in full.

MEETINGS TO NOTE

FRIDAY, 30 DEC.

A.S.E.E. (Coventry and District). "Development of Electrical Equipment for Machine Tools." J. N. Leah. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy Lane. 7.30 p.m.

MONDAY, 2 JAN.

I.E.E. (S. Midlands). Discussion: "Broadening University Courses." Joint meeting with Education Discussion Circle, James Watt Memorial Institute, Birmingham. 6.30 p.m.

PLASTICS INSTITUTE. "Plastics and Textiles." H. A. Thomas. Institution of Electrical Engineers, Savoy Pl, London W.C.2. 2.30 p.m.

I.E.S. (Birmingham). Display of lighting fittings. Bennett Hall, Y.M.C.A., Snow Hill. 6 p.m.

TUESDAY, 3 JAN.

I.E.E. (N. Midlands). "Water-Turbine-Driven Induction Motors." C. L. C. Allan. Leeds and County Conservative Club, South Parade, Leeds. 6.30 p.m.

WEDNESDAY, 4 JAN.

I.E.E. (Southern). "The Planning and Economics of Telecommunication Plant." C. J. Stubbington. The University, Southampton. 7 p.m.

I.E.E. (Sheffield). Christmas Holiday. Lecture: "Colour Television." R. Feinberg. City Hall, Sheffield. 3 p.m.

I.E.E. (Teesside). "The Fylingdales Early Warning Station." D. R. Evans. Cleveland Scientific and Technical Institution, Middlesbrough. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Radar Group). "Automatic Techniques in Civil Air Line Communications Systems." W. E. Brunt. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Yorks). "Instruments and Cherry Blossom—Some Impressions of a Technical Visit to Japan." W. C. Heselwood. University, St. George's Sq, Sheffield 1. 7 p.m.



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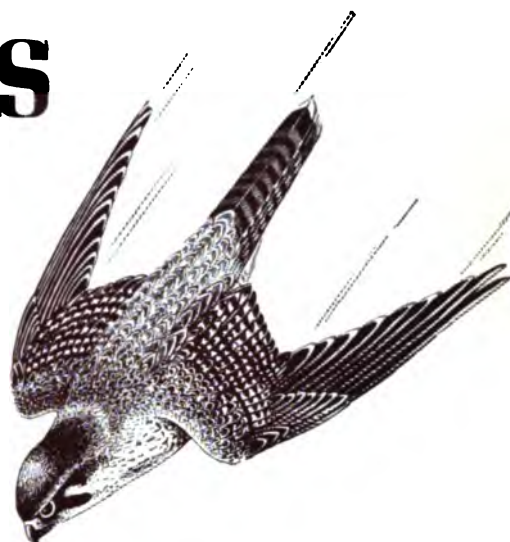
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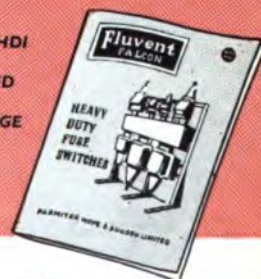
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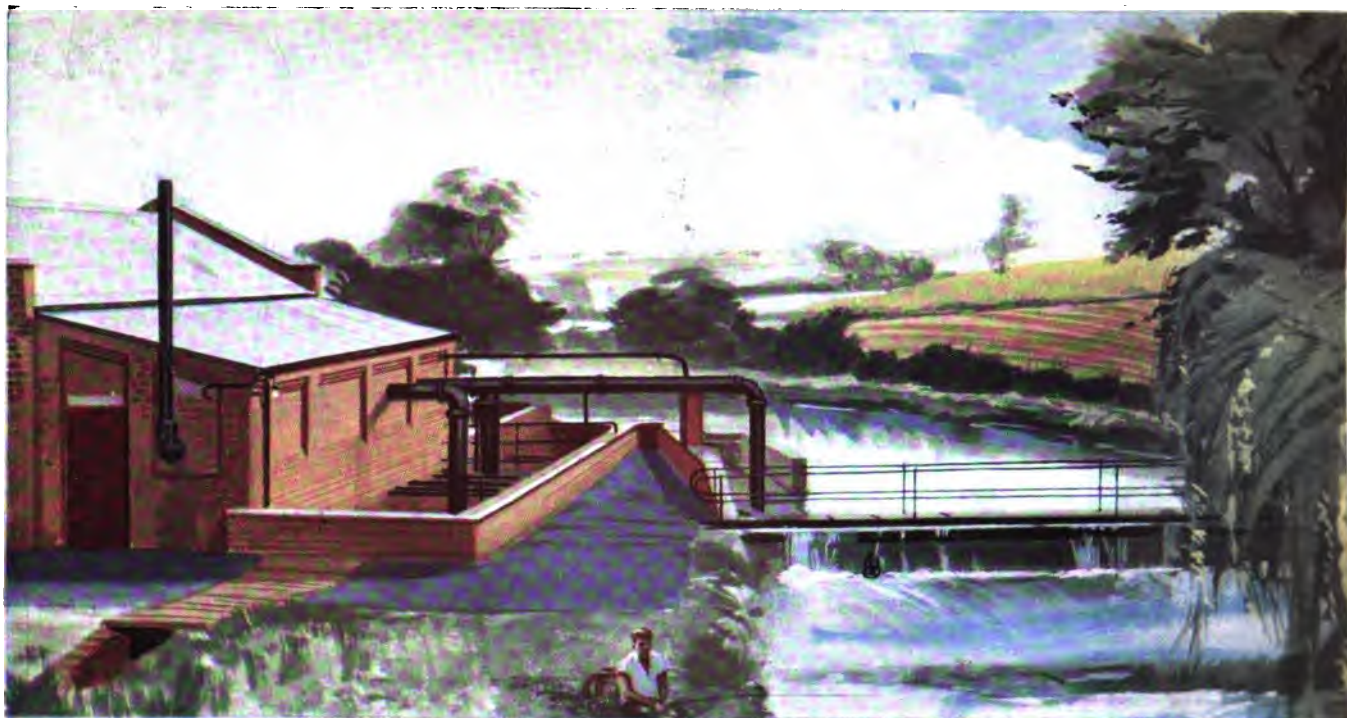
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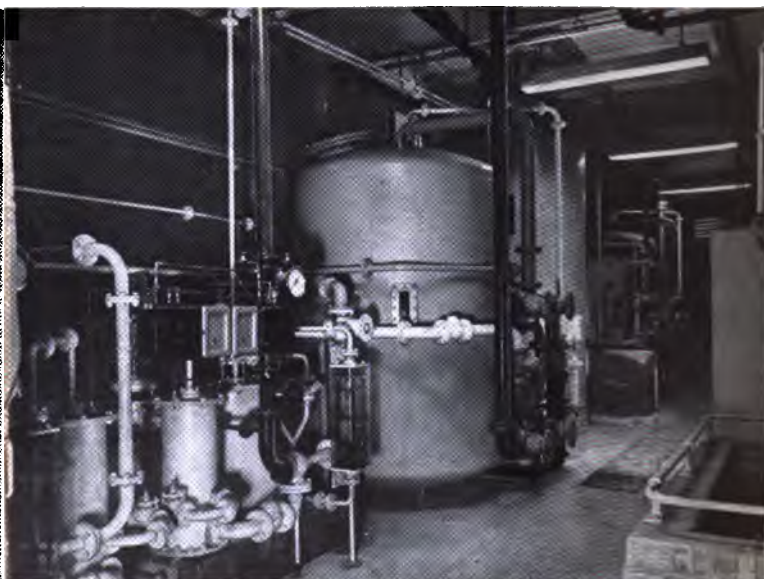
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* The illustration shows de-ionisation plant at North Wilford Power Station producing 75,000 gallons of treated water in 14 hours for high pressure water tube boilers.



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